FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT IMPLEMENTATION REPORT
IN SUPPORT OF RE-ZONING AND SITE PLAN APPROVAL APPLICATIONS

1140 YONGE STREET
City of Toronto
Toronto & East York District

counterpoint ENGINEERING

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File Number: 18072

Prepared For:

1140 Yonge Inc.

1	Issued for Re-Zoning and Site Plan Approval	August 10, 2020
No.	**Revision**	**Date**

EXECUTIVE SUMMARY

This Functional Servicing and Stormwater Management Implementation Report has been prepared on behalf of 1140 Yonge Inc. in support of Re-Zoning and Site Plan Approval applications, to provide for site specific regulations for the subject site. This Report presents a site servicing strategy for the proposed development that addresses the requirements of the applicable regulatory agencies and provides the basis for detailed servicing design. The servicing strategy for the proposed development is summarized as follows:

WATER SERVICING:

- The proposed development is to be serviced by one (1) connection to the existing 300 mmø watermain located on Marlborough Avenue. The water demand requirement of the proposed development for Maximum Day Demand plus Fire Flow is **9,021 L/min**. The proposed development results in an increase in Maximum hour and Maximum Day demand. Site specific watermain pressure tests indicate that the existing 250 mmø watermain meets the water demand for the proposed development.

FOUNDATION DRAINAGE:

- The long-term foundation drainage discharge rate is estimated to be **140m^3/day (1.62 L/s)**. A peak flow rate of **40 USgpm** (**2.21 L/s**) has been incorporated into the sanitary analysis. Discharge of foundation drains will be in accordance with Toronto Municipal Code, Chapter 681 Sewers.
- The quality limits for discharge to the sanitary sewer will satisfy the limits as listed in Table 1 – Limits for Sanitary and Combined Sewer Discharge.

SANITARY SERVICING:

- The proposed development is to be serviced by a new sanitary connection to the existing 375mmø concrete sanitary sewer located on Marlborough Avenue. The estimated peak sanitary flow of the existing site is **0.13 L/s.** The peak sanitary design flow of the proposed development is **4.09 L/s** (including anticipated groundwater foundation drainage), which is a **3.96 L/s** increase in flow.
- A review of the existing and proposed sanitary sewer system downstream of the site was completed and confirms that there is no surcharging in dry conditions. There is wet conditions in existing and proposed conditions but the HGL remains greater than 1.8m below centre-line road elevation. As such, no external upgrades are required.

STORMWATER SERVICING:

- Under existing conditions, stormwater flows uncontrolled to the existing 600mmø concrete storm sewer on Marlborough Avenue. The proposed development will be serviced by a new storm connection to the existing 600mmø concrete storm sewer. The City of Toronto's *Wet Weather Flow Management Policy* identifies performance objectives for runoff from new development sites including water quantity, quality and water balance.

- Quantity - Quantity control will be provided on-site by approximately **71m^3** of underground storage tank in combination with an inlet control to ensure that the 100-year post development peak flows are attenuated to the 2-year predevelopment allowable release rate to Marlborough Avenue.

- Water Balance – A water balance volume of **21.8 m^3** is required to achieve the Tier 2 water balance requirement. This volume will be retained through the re-use of stormwater internally within the site and building for irrigation, and grey water in retail and amenity areas. Details of internal reuse to be provided by the mechanical consultant.

- Quality – Roof, landscape, and non-vehicular impervious surface coverage is approximately 98% of the total site area. Runoff from these areas is considered clean discharge free of oil and grit and therefore quality control is not required.

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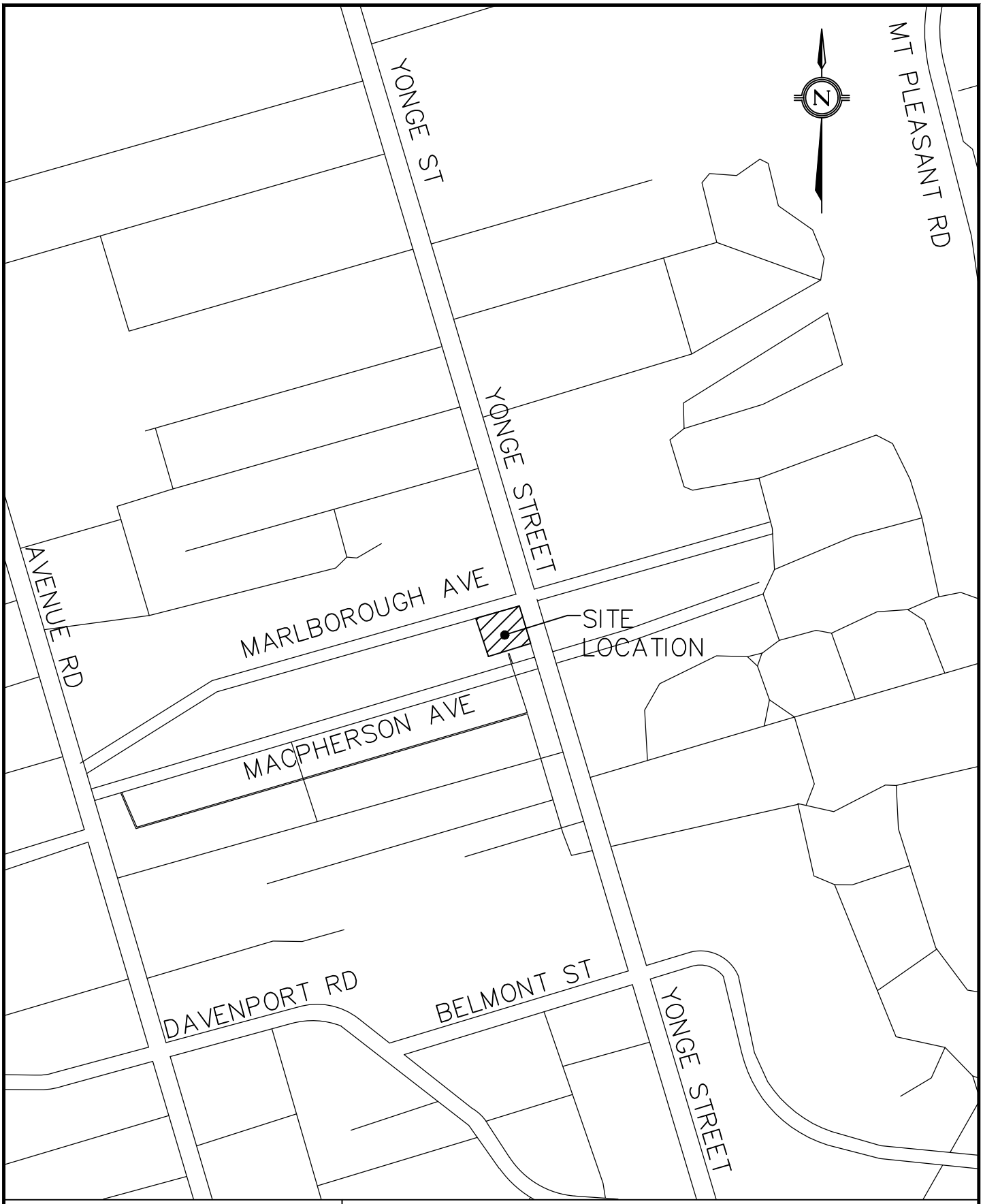
1.0 INTRODUCTION

1.1 BACKGROUND

This Functional Servicing and Stormwater Management Implementation Report has been prepared on behalf of 1140 Yonge Inc. in support of a Rezoning and Site Plan Approval Application for a 0.287 ha site.

The subject site lies in the Summerhill neighborhood in the City of Toronto. It is located at the southwest corner of Yonge Street and Marlborough Avenue. The site is bound by low-rise commercial buildings to the north, south and east, and residential lands to the west. **Figure 1 – Site Location** illustrates the subject site within the context of its surroundings. Existing underground servicing infrastructure is available on Yonge Street and Marlborough Avenue. The 0.287 ha site is currently occupied by a single-storey Staples retail outlet with an asphalt parking area occupying the west portion of the site. An existing 3-storey commercial building currently occupies the extreme southeast portion of the site. For the existing conditions a topographical survey of the site has also been included in **Appendix A**. The proposed site development is a 13-storey mid-rise, mixed-use building with three levels of underground parking. The proposed mix-use building will have 3 townhouses with access on the ground floor along with commercial units on the 1st and 2nd floor. The remaining 11 floors will consist of residential units. Refer to **Appendix A** for the proposed site plan.

This FSR has been prepared to address the site servicing strategy (stormwater, sanitary, and water) in support of a re-zoning and site plan approval application. The proposed servicing works (including stormwater conveyance) will be designed to meet City of Toronto Design Guidelines.



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SITE LOCATION

1140 YONGE STREET
RESIDENTIAL AND COMMERCIAL DEVELOPMENT
TORONTO, ON

DATE: JUNE 2020
PROJECT No. 18072
FIGURE No. 1

2.0 STUDY PARAMETERS

This servicing assessment is based on the review of the following documents and drawings:

- **Architectural Plans** prepared by Audax Architectural Inc.
- **Hydrant Flow Test,** prepared by Lozzi Aqua Check
- **Hydrogeological Investigation** prepared by EXP
- **1140 Yonge Street Combined Sewer Capacity Analysis**, prepared by Civica
- **Plan and Profile Drawings, Yonge Street (Y-16, Y-41)**, provided by City of Toronto
- **Plan and Profile Drawings, Marlborough Avenue (M-244)**, provided by City of Toronto
- **City of Toronto Wet Weather Flow Management Guidelines**, prepared by City of Toronto, Revised November 2006
- **City of Toronto Sewer Atlas Maps**, prepared by City of Toronto, Third Edition January 2010

3.0 WATER SUPPLY

3.1 EXISTING WATER SUPPLY

There is an existing 300mmø watermain on the north side of Marlborough Avenue, and an existing 250mmø watermain on the west side of Yonge Street. There is an existing fire hydrant on the west side of Yonge Street directly adjacent to the site.

3.2 PROPOSED WATER SUPPLY

The site will be serviced by one (1) typical "H" connection to the aforementioned 300mmø watermain on Marlborough Avenue.

The City of Toronto's design criteria states that the water demand used for watermain size selection should be sufficient to satisfy maximum day demand plus fire flow or the peak hour demand, whichever is greater. Fire flow for residential areas will not be less than 4,800 L/min for a 2 hour duration in addition to the maximum daily domestic demand, delivered with a residual pressure of not less than 140kPa. For commercial, institutional and industrial areas, the minimum fire flow available will not be less than 5,000 L/min for 4 hours, delivered with a residual pressure of not less than 140kPa. Fire demand was calculated as per the Fire Underwriter's Survey (FUS) guidelines (1999). The proposed mid-rise building is identified as non-combustible with limited combustible content. The buildings will be sprinklered and will be designed to NFPA 13 and other NFPA standards.

Refer to **Appendix B** for the supporting calculations of the following proposed flows:

- Maximum Hour Demand = 39.5 L/min
- Maximum Day Demand = 20.5 L/min
- Fire Flow Demand (2.0 hours) = 9,000 L/min
- **Maximum Day Demand plus Fire Flow Demand = 9,021 L/min (governs)**

City of Toronto design criteria dictates the following system pressure requirements:

- Average Day and Maximum Day range = 350kPa to 550kPa
- Minimum hour and peak hour range = 275kPa to 700kPa
- Minimum pressure under any non-fire demand scenario = not less than 275kPa
- Minimum residual pressure during maximum day plus fire scenarios = not less than 140kPa
- Maximum static pressure = 690kPa

Based on the flow test results conducted by Lozzi Aqua Check on September 9th, 2019, the measured residual pressure and the observed flow are **34 psi** and **6,337 L/min** respectively. The available flow calculated for the 300mmø watermain on Marlborough Avenue at a minimum residual pressure of 20 psi is **10,191 L/min.** Based on the calculated domestic and fire demands we do not anticipate any external watermain upgrades will be required to accommodate the proposed development. The flow test results for the existing watermain is included in **Appendix B**.

4.0 FOUNDATION DRAINAGE

Discharge of foundation drains to municipal sewers must be in accordance with Toronto Municipal Code, Chapter 681 Sewers. The quality limits for discharge in the sewers must satisfy the limits as listed in Table 1 – Limits for Sanitary and Combined Sewer Discharge and/or Table 2 – Limits for Storm Sewer Discharge of Chapter 681. A Permit to Take Water (PTTW) from the Ontario Ministry of the Environment, Conservation, and Parks (MECP) through an online process is required for Short Term water taking between 50 m^3/day and 400 m^3/day. A PTTW is required for Long Term water taking from a permanent drainage system greater than 50 m^3/day. A permit is required from the City of Toronto for both short term and long term discharges to the municipal sewer system.

A Hydrogeological Investigation was prepared by EXP, dated August 7, 2020 for the proposed redevelopment.

Short Term (Construction) – Groundwater and 25mm rainfall rates are expected to be **220m^3/ day (2.55 L/s)**. A limited PTTW from the MECP will be required for construction dewatering. Discharge will be to the existing 375mmø combined sewer on Marlborough Avenue. Temporary discharge must meet Toronto Table 1 Sanitary/Combined Sewer Discharge Limits prior to discharge to the municipal sanitary sewer. As the TSS levels and other parameters exceed the allowed limit for sewer discharge as per Table 1, a suitable treatment method must be implemented during construction dewatering activities to discharge to the combined sewer on Marlborough Avenue. Details of Construction (short-term) dewatering will be provided by a dewatering contractor prior to construction that satisfies Toronto Municipal Code, Chapter 681 Sewers in order to obtain a short-term discharge permit from the City.

Long Term Discharge - The report indicates an estimated long-term discharge rate of **140m^3/day (1.62 L/s)**. However the sanitary analysis was based on the peak pump rate of **40 USgpm (2.21 L/s)** discussed later in **Section 5.2.** A Category 3 PTTW from the MECP will from the MECP. Discharge will be to the 375mmø combined sewer on Marlborough Avenue An agreement with the City of Toronto for long term discharge will be required. The report indicates that the groundwater quality currently meets the Table 1 – Limits for Sanitary and Combined Sewer Discharge. Details of the sub slab foundation system, sump pit sizing, water meter location and specification and peak flow rates to be provided, by others, at the time of Long Term Discharge Application. A sampling port will be installed at ground level at the property line to ensure quality and quantity control is maintained. Refer to S-1 for the location of the sampling port.

Refer to **Appendix C** for the body of the body of the Hydrogeological Investigation prepared by EXP as well as a pump letter prepared by Smith + Andersen stating the peak pump rate.

5.0 SANITARY SERVICING

5.1 EXISTING SANITARY SERVICING

The existing Staples retail outlet conveys sanitary flow to the existing 375mmø combined sewer on Marlborough Avenue and the Yonge Street combined sewer. The 375mmø combined sewer on Marlborough Avenue flows easterly to a 1200x750mmø sewer on Yonge Street adjacent to the subject site. The combined sewer ultimately outlets to a trunk sewer located east of Yonge Street, south of Crescent Road. In existing conditions, it is estimated that the peak sanitary flow from the existing Staples retail outlet to the combined sewer on Marlborough Avenue is approximately **0.13 L/s.**

5.2 PROPOSED SANITARY SERVICING

The site will be serviced by a new connection to the existing 375mmø combined sewer on Marlborough Avenue.

Using the City of Toronto Sanitary Design criteria the equivalent population for the proposed residential development is approximately **151 persons**. The peak sanitary flow for the proposed development has been calculated to be **4.09 L/s**. This peak flow rate includes the peak anticipated foundation flow from the permanent drainage system based on an assumed pump rate of **40 USgpm (2.21 L/s).** Refer to **Appendix D** for detailed calculations. The proposed development results in an increase of **3.96 L/s** in the peak sanitary flow to the Yonge Street sanitary sewer.

A detailed analysis of the sanitary sewer system from upstream of the proposed development to the aforementioned trunk sewer south southeast of the site on Rosedale Valley Road was completed under both dry and wet weather flow conditions. The detailed analysis incorporates sixteen (16) new developments/re-developments within the drainage boundary.

The analysis determined that for the proposed development:

- The existing sanitary sewer has capacity to accommodate the dry weather flow without surcharge;
- For existing and proposed conditions, the sanitary sewer downstream of the proposed site surcharges during wet conditions. However, the HGL remains at acceptable levels; below 1.8 m from the ground surface;

Based on the conclusions in the downstream sewer analysis, no external sanitary sewer upgrades are required to accommodate the proposed redevelopment. Refer to **Appendix D** for the downstream sanitary sewer capacity analysis, the hydraulic grade line analysis, and the downstream sanitary map.

It should be noted that as the short-term/construction discharge rate to the Marlborough Avenue sanitary sewer of 1.50 L/s is lower than the long-term rate of 4.09 L/s, therefore there is also capacity in short-term conditions with no external upgrades required.

6.0 STORMWATER SERVICING

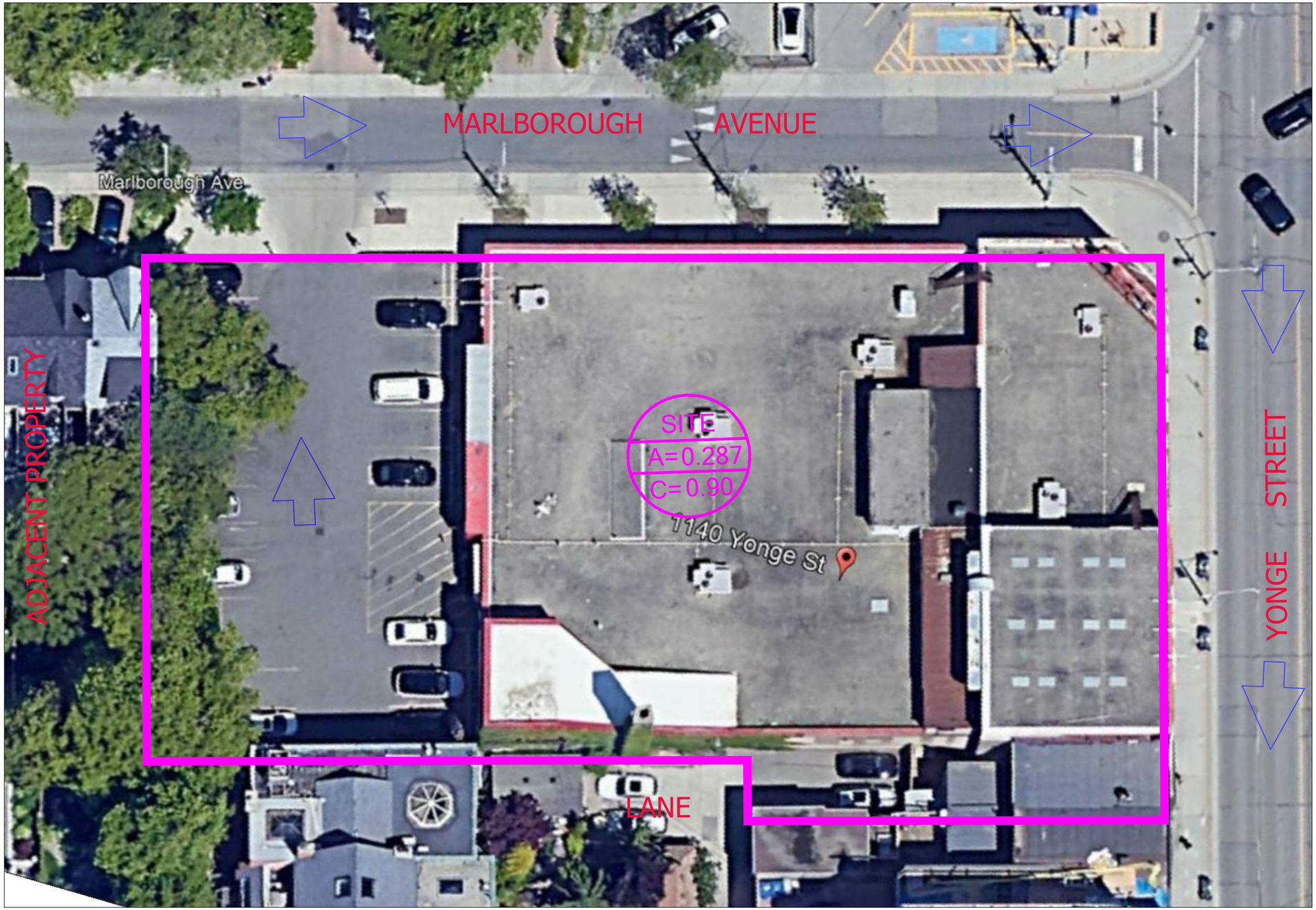
6.1 EXISTING CONDITIONS

There is an existing 600mmø storm sewer on Marlborough Avenue adjacent to the subject site. The storm sewer flows easterly and outlets to a 1350mmø storm sewer on Yonge Street which ultimately outlets to a trunk sewer south of the subject site at the Yonge Street and MacPherson Avenue intersection. Existing storm runoff is directed to the 600mmø on Marlborough Avenue Marlborough Avenue. Refer to **Figure 2** for the existing drainage plan of the existing site conditions. No stormwater management controls have been identified within the existing site; therefore, it is understood that the site currently discharges uncontrolled storm runoff to the storm sewer on Marlborough Avenue on as summarized in **Table 1**.

Table 1 – Existing Site Uncontrolled Runoff

Storm Event	Existing Site Uncontrolled Runoff (L/s)
2-Year	63
5-Year	94
10-Year	116
25-Year	136
50-Year	161
100-Year	179

Refer to **Appendix E** for storm runoff calculations.



LEGEND

EXISTING OVERLAND FLOW DIRECTION

DRAINAGE AREA BOUNDARY

100
A=0.28
C=0.90

AREA ID
AREA (ha)
RUNOFF COEFFICIENT

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RESIDENTIAL AND COMMERCIAL DEVELOPMENT
TORONTO, ONTARIO

EXISTING STORM DRAINAGE

DESIGNED BY: MA	DATE: JUNE 2020
CHECKED BY: RS	PROJECT No. 18072
DRAWING BY: MA	
CHECKED BY: RS	FIGURE No. 2
SCALE: N.T.S	

6.2 ALLOWABLE RELEASE RATE

The sites imperviousness under existing conditions is greater than 50%. Under Toronto's Wet Weather Flow Management Guidelines (WWFMG), the maximum value of C (Runoff Coefficient) used in calculating the pre-development peak runoff rate is limited to 0.50, in this condition this criteria applies.

The allowable release rate for the 0.287 ha site area was determined by calculating the 2-year peak flow with a composite runoff coefficient of 0.50. As a result, the allowable discharge from the subject site is calculated as follows:

$$Q_A = C \times A \times i \times N \text{ (l/s)}$$

Table 2 - Allowable Release Rate

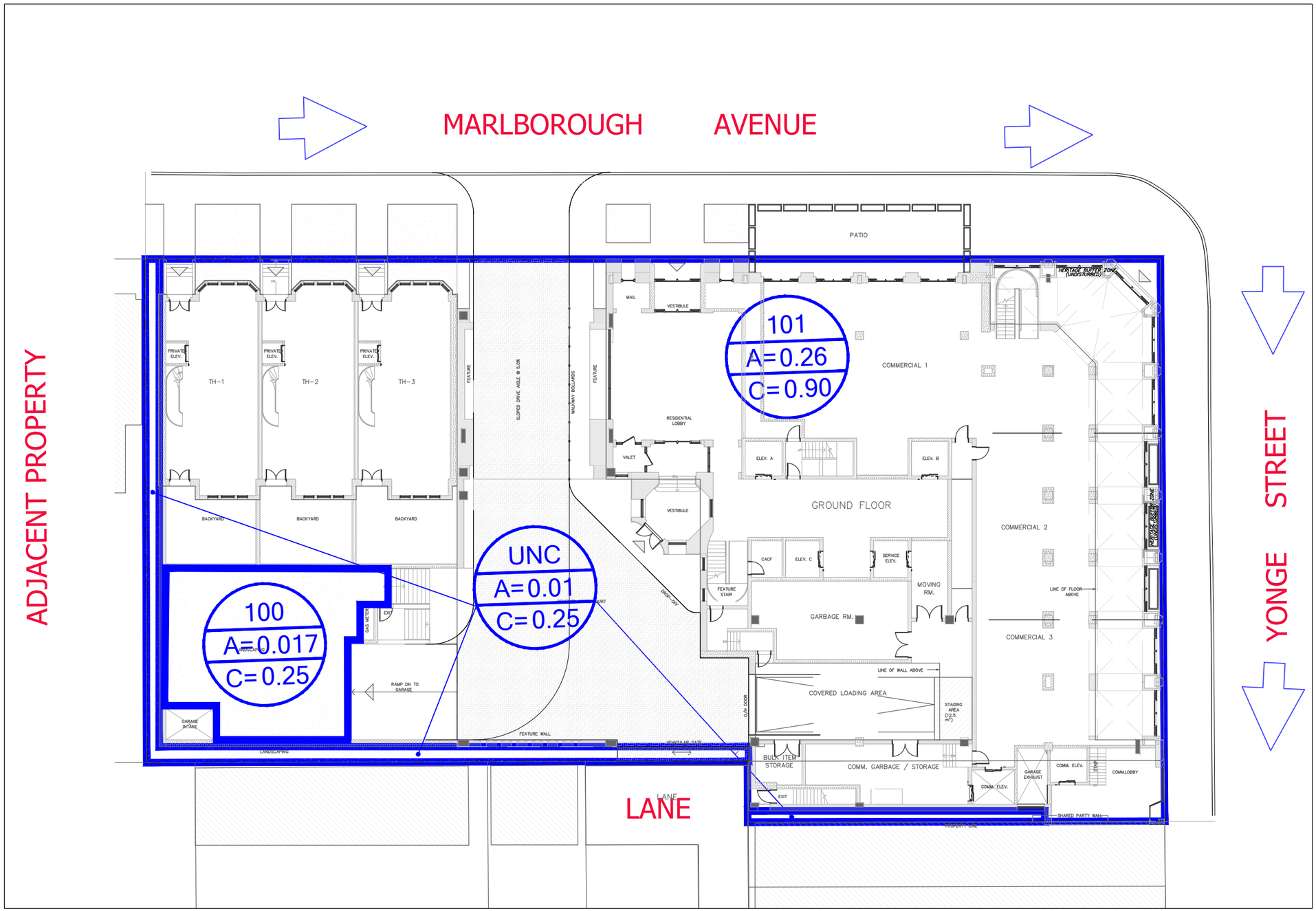
Variables	Site
A - Site Area (ha)	0.287
Tc (min)	10
C - Runoff Coefficient	0.5
i - Intensity	88.19
Q - Release Rate (l/s)	**35.1**

Quantity control will be provided on-site to ensure that the 100-year post development peak flows to the 600mmø Marlborough Avenue storm sewer will be attenuated to the 2-year allowable release rate of **35.1 L/s** as show in Table 2 above. Refer to **Appendix E** for allowable release rate calculations.

6.3 PROPOSED STORMWATER SERVICING

This report has been prepared in accordance with the criteria set by the City of Toronto Weather Flow Management Guidelines (WWFMG). The site will be serviced by the 600mmø storm sewer on Marlborough Avenue.

Under proposed conditions the building, landscaped or non-vehicular areas comprise approximately 98% of the 0.287 ha site. An area of approximately 0.01 ha area along the west and south property lines that flows uncontrolled to the Marlborough Avenue and Yonge Street road allowances. Refer to **Figure 3 – Proposed Storm Drainage.**



LEGEND

OVERLAND FLOW

DRAINAGE AREA BOUNDARY

100
A=0.28
C=0.90

AREA ID
AREA (ha)
RUNOFF COEFFICIENT

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TORONTO, ONTARIO

PROPOSED STORM DRAINAGE PLAN

DESIGNED BY: MA	DATE: JUNE 2020
CHECKED BY: RS	PROJECT No. 18072
DRAWING BY: MA	
CHECKED BY: RS	FIGURE No. 3
SCALE: N.T.S	

6.4 QUANTITY CONTROL

The allowable site release rate for the proposed development was determined by calculating the 2-year peak flow with a maximum value of 50% impervious as per the City of Toronto Wet Weather Flow Management Guidelines. Based on the above, the allowable release rate to the 600mmø Marlborough Avenue storm sewer was calculated to be **35.1 L/s**.

The uncontrolled area (UNC) discussed in Section 6.3 will produce a peak runoff of **1.7 L/s** during the 100-year storm event.

Quantity control will be provided on-site by an underground storage tank within the P1 level of the building in combination with an inlet control device (100 mm orifice plate) to ensure that the 100-year post redevelopment peak flows from the site are attenuated to the 2 year allowable release rate of **35.1 L/s**. A storage volume of approximately **72 m^3** will be required to control the 100-year post development flows to the orifice release rate. Note that an additional 23.3 m^3 volume will be available for the water reuse cistern portion of the tank. Refer to **Appendix E** for detailed calculations.

Table 3 – Peak Flow and Storage Summary - 100-Year Storm Event

Area ID	Area (ha)	Runoff Coefficient	t_c (min)	Storage Available (m^3)	Storage Required (m^3)	100-Year Release Rate (L/s)	Description	Orifice Size (mm)	Allowable Release Rate (L/s)
UNC	0.010	0.25	10	N/A	0	1.7	Uncontrolled	-	-
SITE	0.277	0.79	10	72	72	32.3	Orifice Plate	100mm	35.1
	0.287			72	72	34.0			

1. On-site storage will be provided via an underground storage tank located within the building.
2. Refer to **Appendix D** for modified rational calculations.

As shown in **Table 3** above, the proposed site release rate of **34.0 L/s** during the 100-year storm event will be lower than the allowable release rate of **35.1 L/s.** Refer to **Appendix E** for storage volume calculations.

In situations where the orifice plate is not sufficient, the at grade access lid to the underground storage tank will allow water to discharge overland to Marlborough Avenue. The access lid is to be as per OPSD 401.010 – Type B – Open Cover. The required water reuse volume will be available below the outlet invert and is discussed in further detail later in this report in **Section 6.5.**

The design of all internal piping within the building must provide adequate capacity for full capture and conveyance of all flows generated by storms up to and including the 100-year rainfall event. All design and associated calculations for the internal storm system, including the design of the internal inlet structures, piping and mechanical appurtenances is to be completed by the Mechanical Engineer.

6.5 WATER BALANCE

The Wet Weather Flow Guidelines indicate that the minimum on-site runoff retention requires the proponent to retain all runoff from a small design rainfall event – typically 5 mm (In Toronto, storms with 24 hour volumes of 5 mm or less contribute about 50% of the total average annual rainfall volume). The development is intending to achieve the Toronto Green Standards Tier 2 water balance requirement of 10mm.

To achieve the water balance objectives, the site was categorized by surface types: impervious asphalt/paved/roof, landscaped areas and conventional roof. The initial abstraction values for the impervious surfaces and pervious surfaces were 1 mm and 5 mm, respectively. Additionally, the intensive green roof system on top of the Mechanical Penthouse is being enhanced with the use of ZinCo Floradrain system. This produce increased the IA from 5mm to 11mm. The initial abstraction was determined based on percent of surface area and initial abstraction values of each surface type. Based on the site area of 0.287 ha, 10mm of water balance is equivalent to approximately **28.7 m^3** of total site storage (2870 m^2 x 0.01 m). Without any specific on-site retention measures, the proposed development would achieve the following levels of water balance as seen in **Table 5**.

Table 5 – Achieved Water Balance

Site Description	Fraction of Site Area		Initial Abstraction (mm)	Overall Initial Abstraction (mm)
Non-Green Roof / Impervious Area	78%	0.223 ha	1.0	0.78
*Intensive Green Roof Area	9%	0.025 ha	11.0	0.94
Pervious Area	14%	0.039 ha	5.0	0.69
Total	**100.0%**	**0.287** ha		**2.41**

* Intensive Green Roof Area consists of a ZinCo Floradrain system that stores additional water below the growing medium to be used on demand by the plants. Using the product increases IA from 5mm to 11mm.

Based on **Table 5,** the site will have a shortfall of 7.59 mm (10mm – 2.41 mm) of initial abstraction to achieve the Tier 2 water balance requirement. This is equivalent to approximately **21.8 m^3** of storage. To achieve the Tier 2 water balance requirements, on-site irrigation, and grey-water re-use in the amenity and retail areas will be utilized. The total 72-hour volume of those two measures is 21.8m^3 (15.8m^3 and 6.0m^3 respectively). As such, the Tier 2 water balance criteria is achieved. The re-use storage tank will form part of the underground stormwater storage tank provided for quantity control. The underground storage tank will outlet at an elevation such that a minimum of **21.8 m^3** will be available below the outlet invert for re-use. Refer to **Appendix D** for the water balance calculations, irrigation demand calculations, a letter from the mechanical consultant confirming grey water usage within 72 hours, and manufacturer details regarding the specifications and details of the intensive green roof proposed for the mechanical penthouse roof.

1140 Yonge Inc. is interested in investigating the ability to achieve the Tier 3 water balance criteria of 25mm and will reach out to ECS and Toronto Water to discuss.

6.6 QUALITY CONTROL

The proposed building and non-vehicular areas covers approximately 98% of the site area. Runoff from rooftop, landscape areas and non-vehicular impervious areas are considered to be clean and free of oil and grit. As such, these areas do not require water quality treatment. Therefore, based on site characteristics the site will not require water quality treatment to achieve the 80% TSS removal requirement.

7.0 CONCLUSIONS

This Functional Servicing Report presents a site servicing strategy for the proposed development that addresses the requirements of the applicable design guidelines and provides the basis for detailed servicing design.

We trust this report sufficiently addresses the site servicing requirements and allows for approval of the proposed re-zoning and site plan approval of the subject site for the proposed use described herein. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,
Counterpoint Engineering Inc.

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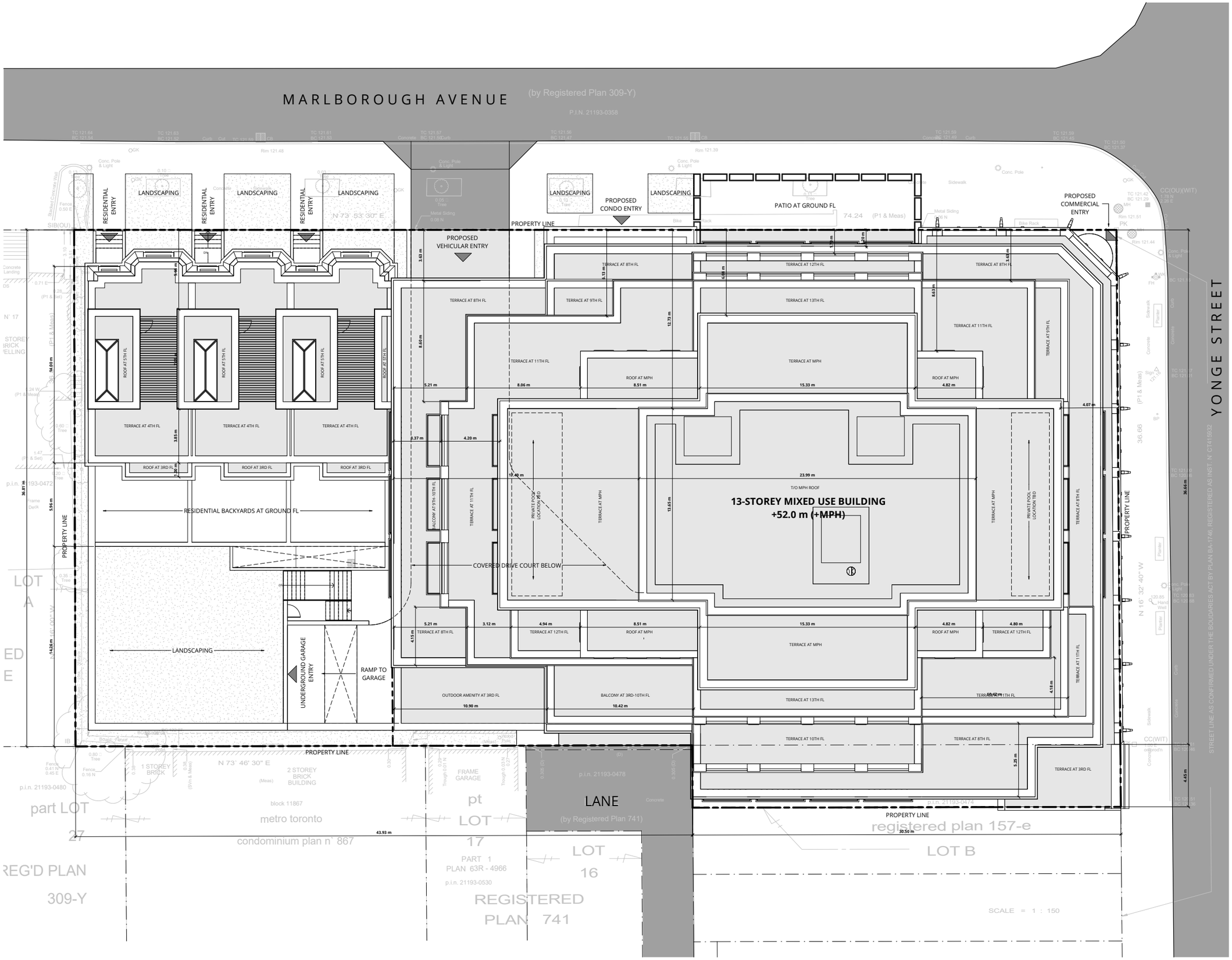
Appendix A



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NO.	REVISION / ISSUED FOR	DATE
2	ISSUED FOR COORDINATION	2020-07-01
1	ISSUED FOR COORDINATION	2020-05-15

DRAWING TITLE:

SITE PLAN

PROJECT:

1140 YONGE STREET

TORONTO, ONTARIO

PROJECT NORTH:

SCALE: 1 : 100
PLOT DATE: 7/1/2020 7:45:28 PM
DRAWN BY: Author
FILE NO.: 18-012

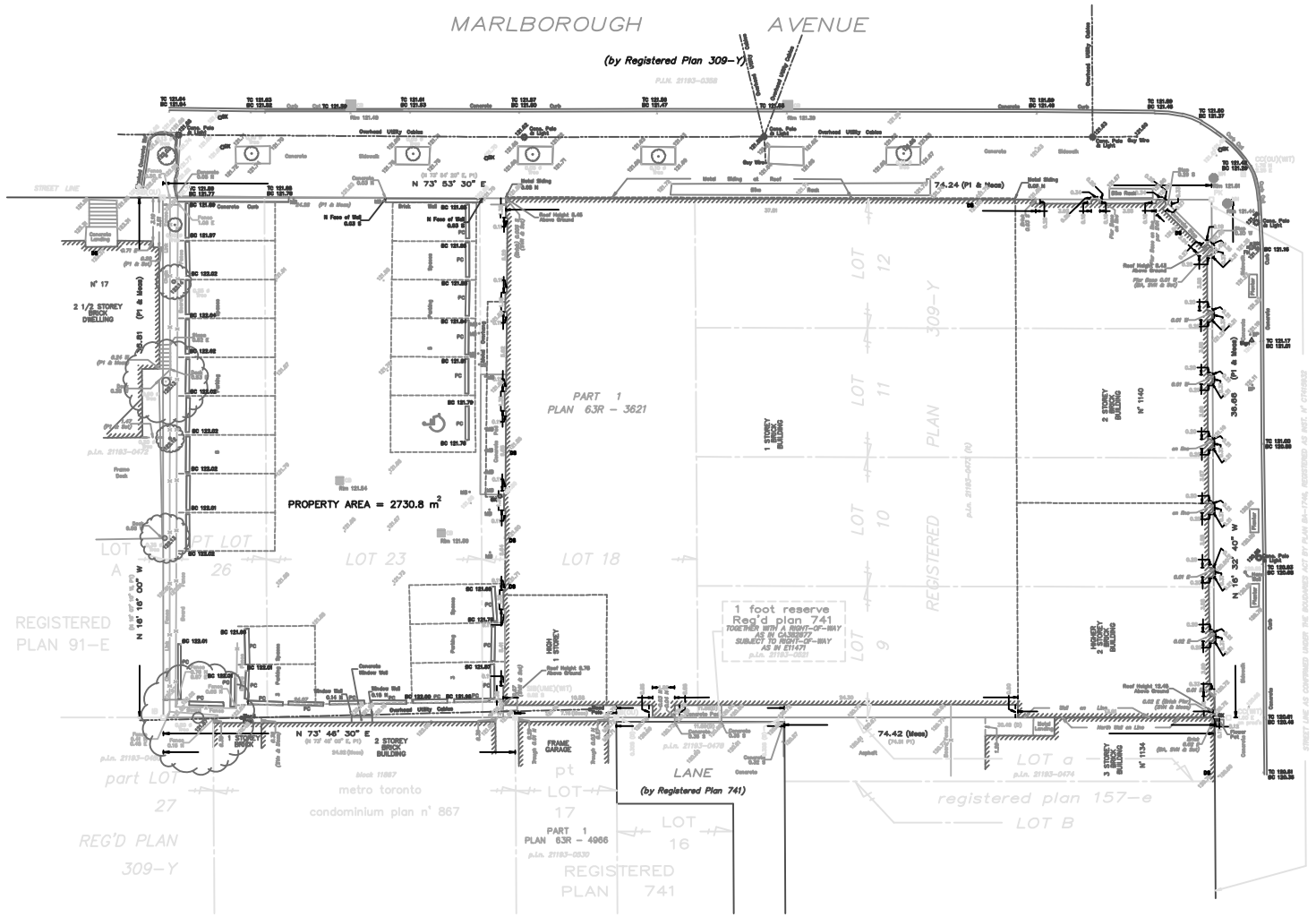
A-004

PLAN OF

LOTS 9, 10, 11, 12, 18 & 23 & PART OF LOT 26 REGISTERED PLAN 309–Y

CITY OF TORONTO

SCALE = 1 : 150



METRIC

DISTANCES SHOWN HEREON ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

ELEVATION NOTE

ELEVATIONS SHOWN HEREON ARE GEODETIC AND IN METRES AND ARE REFERRED TO THE ESTABLISHED ELEVATION OF 122.193 METRES (CGVD–1928:PRE–1978).

CITY OF TORONTO BM–846

BEARING NOTE

BEARINGS ARE ASTRONOMIC AND ARE REFERRED TO THE WESTERLY LIMIT OF YONGE STREET HAVING A BEARING OF N 16° 32' 40" W AS SHOWN ON PLAN BA–1746.

LEGEND

□	DENOTES MONUMENT PLANTED
■	MONUMENT FOUND
WIT	WITNESS
CC	CUT CROSS
IB	IRON BAR
PK	"PK" NAIL & WASHER
RP	REGISTERED PLAN 309–Y
SVN	PLAN OF SURVEY BY SPEIGHT, VAN HOSTRAND, WARD & ANDERSON O.L.S. DATED OCTOBER 22nd, 1953
PI	PLAN 63R–3621
GU	GROSS UNKNOWN
P.I.N.	PROPERTY IDENTIFIER
D	INST. N° CA393877
BF	BOARD FENCE
TC	TOP OF CURB
BC	BOTTOM OF CURB
CB	CATCH BASIN
MH	MAINTENANCE HOLE
WK	WATER KEY
GK	GAS KEY
ø	DIAMETER
FH	FIRE HYDRANT
DE	DOORSILL ELEVATION
MB	METAL BOLLARD
PC	PRECAST CONCRETE CURB
BP	BIKE POST

LSG LAND SURVEY GROU
ONTARIO LAND SURVEYORS
777 THE QUEENSWAY, UNIT 1, TORONTO, ONTARIO, M8Z 1
Tel: 416–252–2511 416–467–8023 Fax: 416–252–1501

DRAWN : A. RYCHTER | CHECKED BY : | PLAN N°:

Appendix B

Counterpoint Engineering Inc.

Water Demand Design Calculations

Project: 1140 Yonge Street
Project No: 18072
Location: Toronto, Ontario
Site Area: 0.273 ha

Population

1BR/1BR+Den	1.4	ppu
2BR/2BR+Den/	2.1	ppu
3BR/3BR+Den	3.1	ppu
Townhouses	2.7	ppu
Commercial / Retail	1.1	persons/100m^2
Offices	3.3	persons/100m^2

	Residential Units					GFA
	1B / 1B+D	2B / 2B + D	3B / 3B+D	Townhouses	Total Units	Area (m^2)
Level 1	0	0	0	3	3	**1,732**
Level 2	0	0	0	0	0	**1,718**
Level 3	3	5	0	0	8	**1,954**
Level 4	2	7	0	0	9	**1,699**
Level 5	2	7	0	0	9	**1,608**
Level 6	2	7	0	0	9	**1,608**
Level 7	2	7	0	0	9	**1,608**
Level 8	0	4	2	0	6	**1,337**
Level 9	0	2	2	0	4	**1,299**
Level 10	0	2	2	0	4	**1,225**
Level 11	0	1	2	0	3	**943**
Level 12	0	1	1	0	2	**792**
Level 13	0	0	0	0	0	**725**
TOTAL UNITS / AREA (m^2)	**11**	**43**	**9**	**3**	**66**	**18,248**

	Population 1BR / 1B + D	Population 2BR / 2BR + D	Population 3BR / 3BR + D	Townhouse Population	Population Commercial	TOTAL POPULATION
Residential	16	91	28	11	16	135
Total Equivalent Population						**135**

City of Toronto Watermain Guidelines

Per Capita Demand

Single Family	320	(L/capita/day)
Multi-Unit	191	(L/capita/day)

Peaking Factors

Land Use	Minimum Hour	Maximum Hour	Maximum Day
Residential	0.70	2.48	1.65
Commercial	0.84	1.20	1.10
Industrial	0.84	0.90	1.10
Institutional	0.84	0.90	1.10
Apartment	0.84	2.50	1.30

*Values used for Residential (Multi-Unit) Land Use

Water Demand based on Equivalent Population

Land Use	Population	Minimum Hour (L/min)	Maximum Hour (L/min)	Maximum Day (L/min)	Fire Flow Required (L/min)	Fire Flow Duration (hr)*	Max Day + Fire Flow (L/min)
Residential (Multi-Unit)	119	13.3	39.5	20.5	9000.0	2	-
Totals	**119**	**13.3**	**39.5**	**20.5**	**9000**	**2.00**	**9021**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - PROPOSED DEVELOPMENT
Fire Underwriters Survey

Project : **1140 Yonge Street**
Project No: **18072**

Guide for Determination of Required Flow Copyright I.S.O

$$F = 220C\sqrt{A}$$ where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) Fire Flow

Type of Construction:	NC
C=	0.8
A*=	2781 m^2
F=	**9,281 L/min**

Note: Assuming non-combustible building. Assuming Vertical Openings are adequately protected.
Area is the total of the largest floor (3rd Floor) plus 25% of the next 2 adjoining floors above.

2) Occupancy Reduction/Surcharge

Contents Factor:		LC		
Reduction/Surcharge of		-15%	=	-1,392 L/min
F=	9281L/min +	-1392 L/min	=	7,889 **L/min**

3) System Type Reduction

NFPA 13 Sprinkler:	YES	30%
Standard Water Supply:	YES	10%
Fully Supervised:	YES	10%
Total		50%

Reduction of	50%	L/min	=	3,944 L/min
F=	7889L/min -	3,944 L/min	=	3,944 **L/min**

4) Separation Charge

Building Face	Dist(m)	Charge
North	18	15%
East	25	10%
South	15	15%
West	4	20%
Total		60% **of** 7888.8 **L/min** = 4,733 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 3944L/min + 4733L/min = 8,678 **L/min** (2,000L/min<F<45,000L/min)

F=	9,000	**L/min** (round to the nearest 1,000L/min)
F=	150	**L/s**
F=	2,378	**gpm**

Counterpoint engineering

NFPA Theoretical Flow Calculations

Project Name: **1140 Yonge Street**
Project Number: **18072**

Based on National Fire Protection Association Guidelines, the available flow at the minimum residual pressure of 20psi can be calculated based on the observed flow at the observed pressure readings, as follows:

$$\mathbf{Q_F = 29.83 \times c \times d^2 \times p^{0.5}}$$, where

Q_F = observed flow (US GPM)
c = hydrant nozzle coefficient (0.90 - 0.95)
d = nozzle diameter (in)
p = observed pitot pressure

$$\mathbf{Q_R = Q_F \times h_F^{0.54} / h_R^{0.54}}$$, where

Q_R = available flow
Q_F = observed flow (US GPM)
h_F = drop from measured static to desired baseline pressure
h_R = drop from measured static to measured residual pressure

Based on flow test results obtained by Lozzi Aqua Check on September 9, 2019

c =	0.9	
d =	2.5	in
number of ports =	2	
p =	25	

Q_F = 1678 US GPM

Measured Static Pressure =	44	psi	
Measured Residual Pressure =	34	psi	
Desired Residual Pressure =	20	psi	, minimum per City of Toronto design criteria

Q_R = 2692 US GPM per fire conneciton
10,191 L/min

Lozzi Aqua Check

4820 18th Sideroad

Schomberg, Ontario

L0G-1T0

Massimo Lozzi Cell: 416 990-2131

E-mail: lozziaquacheck@gmail.com

Hydrant Flow Test Form

Job Location: 1140 Yonge St,Toronto

Date: September 9,2019

Test Data

Time of Test: 10:00 am

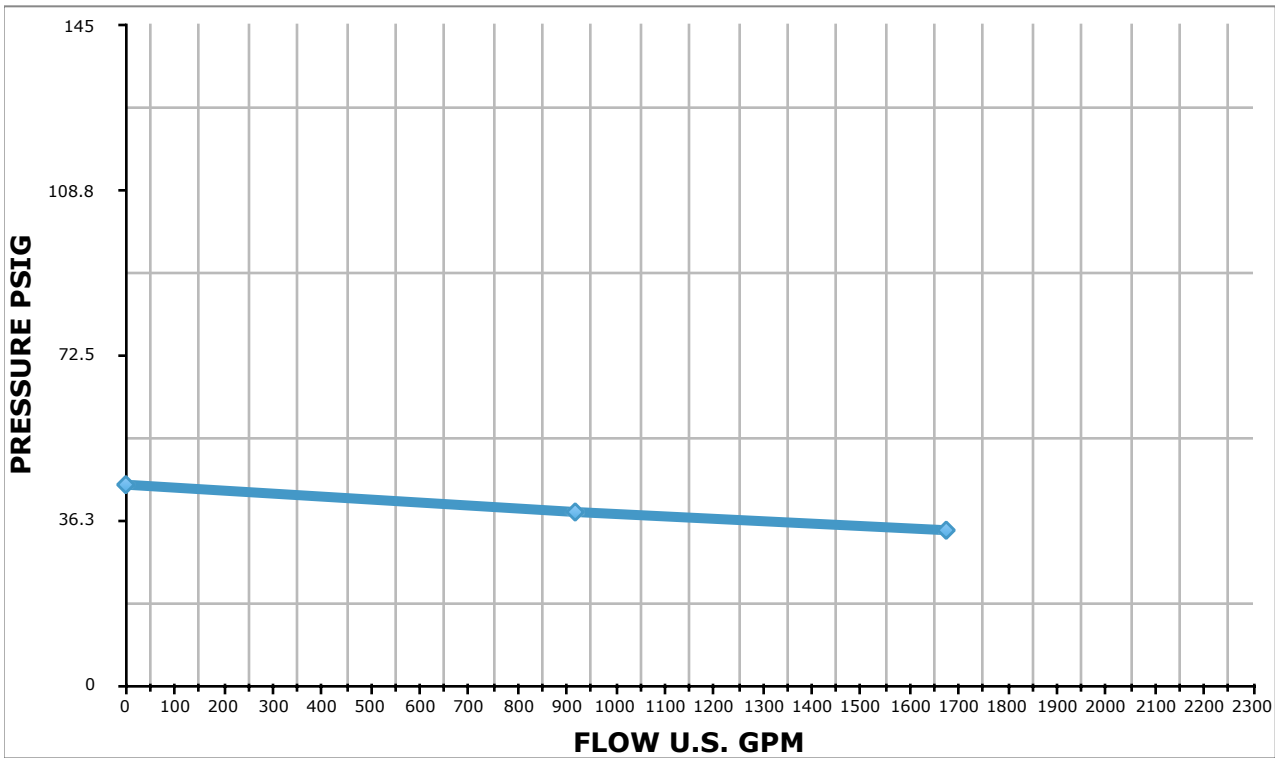
Location of Hydrant: flow hydrant in front of 22 Marlborough Ave.Static next hydrant west.

Main Size: 300 CI

Static Pressure: 44 psi

	Number of Outlets & Orifice Size	Pitot Pressure (psi)	Flow (U.S. G.P.M.)	Residual Pressure (psi)
1.	Static	0	0	44
2.	1 x 2 ½	30	917	38
3.	2 x 2 ½	25	1674	34

Note :Flow test conducted in accordance with NFPA Std 291



Appendix C

1134 and 1140 Yonge Street, Toronto, Ontario

Hydrogeological Investigation

Client:
1140 Yonge Inc.
31 Scarsdale Road, Unit 5
Toronto, Canada

Attention: Mr. Andrew Murphy

Type of Document:
Final Report

Project Name:
1140 Yonge Street, Toronto, Ontario

Project Number:
BRM-00249626-A1

EXP Services Inc.
1595 Clark Boulevard
Brampton, ON, L6T 4V1
t: 905.793.9800
f: 905.793.0641

Date Submitted:
2019-08-09
Revised: August 7, 2020

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1. Introduction

1.2 Project Description

EXP Services Inc. (EXP) was retained by 1140 Yonge Inc. to prepare a Hydrogeological Investigation Report associated with the proposed development located at 1134 and 1140 Yonge Street, Toronto, Ontario (hereinafter referred to as the 'Site').

It is our understanding that the proposed development plan consists of a thirteen (13) storey structure with three (3) levels of underground parking. The Site location plan is shown on Figure 1. The architectural drawings are provided in Attachment F.

EXP conducted a drilling campaign at the Site on April 26, 2019. Alston Geotechnical Consultants Inc. completed the geotechnical studies based on the results of the EXP's field operation on May 16, 2019. The pertinent information gathered from the geotechnical studies is utilized for this report.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation are as follows:

- Establish the local hydrogeological settings within the Site;
- Assess construction dewatering flow rate (short-term);
- Assess post-construction dewatering flow rate (long-term);
- Assess groundwater quality; and
- Prepare a Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, EXP has completed the following scope of work:

- Review available geological and hydrogeological information for the Site;
- Drill and install four (4) 50-mm diameter monitoring wells at three (3) locations across the Site, including three (3) shallow and one (1) deep to approximate depths of 12 and 20 meters below ground surface, respectively where a pair of shallow and deep wells are in a nested configuration;
- Develop and conduct Single Well Response Tests (SWRT) on all onsite monitoring wells to assess hydraulic conductivities of the saturated soils at the Site;
- Conduct an elevation survey at the monitoring wells locations;
- Complete six (6) rounds of groundwater level measurements at all monitoring wells;
- Collect one (1) groundwater sample to be analyzed for parameters, as stated in the City of Toronto Sanitary and Storm Sewer Use By-Law;
- Evaluate the information collected during the field investigation program, including borehole geological information, Water Well Records (WWR), SWRT results, groundwater level measurements and groundwater water quality;
- Prepare site plans, cross sections, geological mapping and groundwater contour mapping for the Site;
- Estimate construction dewatering flow rates (short-term);
- Estimate post-construction dewatering flow rates (long-term);

- Provide recommendations on the Water-Taking Permits, as required by the Ministry of Environment, Conservation and Parks (MECP) and on Sewer Discharge Agreements (SDA) for the construction and post-construction phases, as requested by the City of Toronto;
- Conduct three (3) months of groundwater monitoring as per the City's requirements; and
- Prepare a Hydrogeological Investigation Report.

It should be noted that the soil samples and corresponding field data collected during the drilling operation were provided to Alston Geotechnical Consultants Inc to prepare the Geotechnical Investigation report for the Site. The pertinent information provided in the noted geotechnical report is utilized for this Hydrogeological Investigation Report.

The hydrogeological investigation was prepared in accordance with the Ontario Water Resources Act, Ontario Regulation 387/04, and Toronto Municipal Code 681-Sewers. The scope of work outlined above is prepared to assess dewatering and does not include a review of Environmental Site Assessments (ESAs).

1.4 Review of Previous Reports

The following report was reviewed as part of this Hydrogeological Investigation:

- Alston Geotechnical Consultants Inc. (May 16, 2019), Draft Geotechnical Investigation, Proposed Building Development, 1140 Yonge Street, Toronto, ON, prepared for Watters Environmental Group Inc.
- Audax Architecture Inc. (July 27, 2020), Architectural Drawings, 1140 Yonge Street, Toronto, Ontario.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is in a physiographic region named as the Iroquois Plain, and the physiographic landform is known as Sand Plains (Chapman & Putnam, 2007). The Iroquois Plain was created along the shores of former Lake Iroquois, an ancient glacial lake. The noted Plain primarily consists of shallow water sandy deposits. The topography of the Iroquois Plain is relatively flat with a gradual slope to the south, toward Lake Ontario. A shorecliff, roughly 550 m north of the Site, separates the Iroquois Plain from the South Slope.

2.1.2 Regional Geology and Hydrogeology

The surficial geology of the Site is described as coarse textured (foreshore-basinal) glaciolacustrine deposits, which consist of sand, gravel, minor silt and clay (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

According to the Oak Ridges Moraine Groundwater Program (2019), the thickness of overburden within the Site boundary ranges between 38 meters. The subsurface stratigraphy of the Site from top to the bottom can be described in the following sequence (TRCA, 2009 and Oak Ridges Moraine Groundwater Program, 2019):

- **Halton Till**: This geologic unit has not been mapped within the Site boundary.
- **Oak Ridges Moraine (or equivalent)**: This lithologic unit has not been mapped within the Site boundary.
- **Newmarket Till**: This lithologic unit has not been mapped within the Site boundary.
- **Thorncliffe**: This geology formation generally consists of glaciofluvial (sand, silty sand) or glaciolacustrine deposits (silt, sand, pebbly silt and clay). Top elevation of this unit within the Site boundary is approximately at 118 masl.
- **Sunnybrook**: This lithologic unit predominately consists of silt and clay. Top elevation of this unit within the Site boundary is approximately at 110 masl.
- **Scarborough**: This geology unit consists of peat sand overlaying silt and clay deposits. Top elevation of this unit is approximately at 105 masl.
- **Bedrock**: Bedrock primarily consists of interbedded shale, limestone, dolostone, and siltstone, which corresponds to Georgian Bay Formation of Upper Ordovician age (Ministry of Northern Development and Mines, 2012). Bedrock surface elevation of this unit is approximately at 83 masl.

Regional groundwater across the area flows south, towards Rosedale Valley, to a nowadays buried tributary of the Don River, which eventually empties into the Lake Ontario (Oak Ridges Moraine Groundwater Program, 2018). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Well Records from the Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) Database were reviewed to determine the number of water wells present within a 500-m radius of the Site centroid. The MECP WWR database indicates a total of forty-eight (48) well records, which are identified offsite. The locations of the MECP WWR within 500 m of the Site are shown on Figure 3. A summary of the WWR is included in Appendix A.

The database also indicates that the offsite wells are at an approximate distance of forth-five (45) meters or greater from the Site centroid. All offsite wells were reportedly identified as monitoring and observation wells, test holes, and/or listed with unknown use. There are no records of water supply wells. The reported water levels ranged from an approximate depth of 1.0 (one) to 11.6 meters below ground surface (mbgs).

2.2 Site Setting

2.2.1 Site Topography

The Site is in an urbanized area. The topography gradually slopes south-southeast towards Lake Ontario.

As part of this Hydrogeological Investigation, EXP surveyed the existing monitoring wells onsite. Based on the survey data, the surface elevation of the Site approximately ranges between 121.77 to 121.89 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is located within the watershed of the Don River. No surface water bodies are located onsite. The nearest surface water feature is Yellow Creek, a tributary of the Don River named, which lies approximately 600 meters northeast of the Site boundary. Lake Ontario is approximately 4.5 km from the Site boundary to the southeast.

2.2.3 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report, which was prepared by Alston Geotechnical Consultants Inc. for Watters Environmental Group Inc. (Alston, 2019). The soil descriptions are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in each borehole and the results of moisture content determinations are presented on the attached borehole logs (Appendix B). The interpreted geological cross-section is provided in Figure 5. The geologic boundaries shown on the cross-section are adjusted to the geodetic datum based on the EXP's survey data.

It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of hydrogeological investigation and shall not be interpreted as exact planes of geological change.

The "Notes on Sample Description" preceding the borehole logs should be read in conjunction with this report. Based on the results of the geotechnical investigation (Alston Geotechnical Consultants Inc., May 16, 2019), the general subsurface soil stratigraphy consists of the following units:

Asphalt and Fill

The asphalt layer, overlaying a granular fill is approximately 50-mm in thickness. The granular fill extends to an approximate depth of 0.2 mbgs

Layered Silty Clay

A layered silty clay unit underlies fill material. The noted layer apparently extends beyond the maximum depth of investigation onsite. Silty clay unit contains seems of silt and fine sand, with a varying thickness between 80 mm and 400 mm.

It is recommended that borehole investigation be conducted on the eastern part of the property to assess the presence of an aquifer in that portion of the site.

3 Results

3.1 Monitoring Well Details

The monitoring well network installed as part of the Geotechnical Investigations at the Site consists of the following:

- Three (3) shallow monitoring wells, including MW 101 through MW 103, which are installed to an approximate depth range between 11.42 and 12.35 mbgs.
- One (1) deep well (DMW 101) is installed to an approximate depth of 20 mbgs. It should be noted that MW101 and DMW101 are in a nested configuration;
- Each well is equipped with a 50-mm PVC casing and a three (3)-meters long screen; and
- Each well is equipped with flush-mount protective casing.

Borehole and monitoring well installation logs are provided in Appendix B. The monitoring well locations are shown on Figure 4.

3.2 Water Level Monitoring

As part of the Hydrogeological Investigation, static water levels in the monitoring wells were recorded in six (6) monitoring events, including May 13 and 27, June 19 and 25, as well as July 16 and 31 of 2019. A summary of all static water level data as it relates to the elevation survey is summarized in Table 3-1 below.

The groundwater elevation recorded in the shallow wells ranged from 115.55 masl (6.21 mbgs at MW 102 on July 16, 2019) to 117.13 masl (4.69 mbgs on May 13, 2019). The groundwater elevation recorded in the deep well ranged from 109.40 masl (12.41 mbgs on June 19, 2019) to 109.82 masl (11.99 mbgs on June 25, 2019).

The wells installed as part of this investigation assessed a deep groundwater level (piezometric level) and not the first groundwater table. For the design of water foundations without perimeter and foundation drainage systems, shallower wells will be required to evaluate the shallow groundwater table, and the hydrogeologist needs to be consulted during the design process.

Table 3-1: Summary of Measured Groundwater Elevations

Monitoring Well ID	Ground Surface Elevation (masl) *	Approximate Full Well Depth (mbgs)**	Depth	May 13, 2019	May 27, 2019	June 19, 2019	June 25, 2019	July 16, 2019	July 31, 2019
DMW 101	121.81	20.05	mbgs	18.40	17.16	12.41	11.99	11.25	10.93
			masl	103.41	104.65	109.40	109.82	110.56	110.88
MW 101	121.81	12.16	mbgs	4.69	4.94	5.02	4.90	5.04	5.02
			masl	117.13	116.87	116.79	116.91	116.77	116.79
MW 102	121.77	12.35	mbgs	6.14	6.13	6.14	6.16	6.21	6.18
			masl	115.63	115.63	115.63	115.60	115.55	115.59
MW 103	121.89	12.18	mbgs	5.07	5.05	5.07	5.28	5.18	5.15
			masl	116.82	116.84	116.82	116.61	116.71	116.74

Notes:
mbgs: meters below ground surface
masl: meters above sea level
* Based on survey data completed as part of this Hydrogeological Investigation
** Based on the field measurements

Groundwater contours of the shallow water-bearing zone are shown on Figure 6. Accordingly, at the Site, the horizontal groundwater flow direction in the shallow zone is interpreted to be southwest of the Site, towards Lake Ontario. According to the Oak Ridges Moraine Groundwater Program website, the regional groundwater flow direction is shown to be southward. The deviation of the local from the reginal groundwater flow direction is likely dictated by local underground features such as existing sewer and watermain systems.

Comparison of water levels measured in the nested wells (MW 101 and DMW 101) indicates a downward vertical groundwater gradient between the shallow and deep water-bearing zones.

It should be noted that groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions; this may also affect the direction and rate of flow. It is recommended to conduct seasonal groundwater level measurements to provide more information on seasonal groundwater level fluctuations.

3.3 Hydraulic Conductivity Testing

Four (4) Single Well Response Tests (SWRT's) were completed on monitoring wells DMW 101, MW 101, MW 102, and MW 103 on May 13, 2019. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the AQTESOLV Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix C.

A summary of the hydraulic conductivity (K) values estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)*	Screen Interval (mbgs)		Soil Formation Screened **	Estimated Hydraulic Conductivity (m/s)
		From	To		
DMW 101	20.05	17.05	20.05	Silty Clay	2.2×10^{-7}
MW 101	12.16	9.16	12.16	Silty Clay	7.2×10^{-7}
MW 102	12.35	9.35	12.35	Silty Clay	1.5×10^{-7}
MW 103	12.18	9.18	12.18	Silty Clay	1.5×10^{-6}
				Highest Estimated K Value	1.5×10^{-6}
				Geometric Mean of the Estimated K Values	4.4×10^{-7}

* Based on the field measurements
* Based on the geotechnical borehole logs (Alston, 2019)

SWRTs provide estimates of K for the geological formation in the immediate media zone surrounding the well screens and may not represent a bulk formation hydraulic conductivity. As shown in Table 3-2, the highest K for the tested water-bearing zones is estimated to be 1.5 x 10^{-6} m/s, and the geometric mean of the K values is to be 4.4 x 10^{-7} m/s.

3.4 Groundwater Quality

To assess the suitability for discharge of pumped groundwater to the sewers owned by the City of Toronto during dewatering activities, one (1) groundwater sample was collected from monitoring well MW101 on May 13, 2019 using a peristaltic pump.

The sample was collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted for analysis to Bureau Veritas (formerly Maxxam Analytics Inc.), a CALA certified independent laboratory in Mississauga, Ontario.

When compared to the Sanitary Sewer By-Law Limits (Table 1) the laboratory Certificate of Analysis (CofA) showed that all parameters conform the Sanitary By-Law limits (Table 1).

When compared to the Storm Sewer By-Law Limits (Table 2), the CofA showed that the concentrations of Total Suspended Solids (TSS), Total Manganese (Mn), and Total Zinc (Zn) were reported above the Storm Sewer Use By-Law criteria.

Analytical results are provided in Appendix D. A summary of the pertinent results is provided in Table 3-3 below.

Table 3-3: Summary of Analytical Results

Parameter	City of Toronto Sanitary and Combined Sewer Discharge Limit (Table 1)	City of Toronto Storm Sewer Discharge Limit (Table 2)	Concentration MW 101 May 13, 2019
Total Suspended Solids (mg/L)	350	15	**32**
Total Manganese (Mn) (µg/L)	5,000	50	**92**
Total Zinc (Zn) (µg/L)	2,000	40	**140**

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

For the long-term dewatering discharge to the City of Toronto's Sewer system (post-development phase), and based on the water quality test results, the water is suitable to be released into the Sanitary Sewer system without using a treatment system. However, the water is not suitable to be discharged into the Storm Sewer system without using an appropriate pre-treatment system, as required.

It is noted that the water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the City of Toronto. Dewatering (short and long term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond Site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was conducted under static conditions. As a result. monitoring may be required during dewatering activities (short and long term) to monitor potential migration, and this should be performed more frequently during early dewatering stages.

An agreement to discharge into the sewers owned by the City of Toronto will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

4 Construction and Post-Construction Dewatering Assessments

4.1 Dewatering Rate Assumptions

It is our understanding that the proposed development plan is to build a thirteen (13) storey structure with three (3) levels of underground parking. The architectural drawings are provided in Appendix F.

It should be noted that shoring drawings were not available at the time of writing this report. For this assessment, it was assumed that the proposed construction plans include an excavation with shoring extending to the Site boundaries. EXP should be retained to review the assumptions outlined in this section, should the proposed shoring design change. Table 4-1 shown below presents the assumptions used to calculate the dewatering rates of the Site.

Table 4-1 Dewatering Estimate Assumptions for Short-Term and Long-Term Dewatering

Input Parameter		Assumption	Notes
Ground Surface Elevation		121.89 masl	Approximate elevation based on the survey data completed by EXP in 2019
Groundwater Elevation		118.13 masl	The highest groundwater elevation measured at the Site (117.13 masl at MW 101 on May 13, 2019) plus one (1) meter to account for seasonal fluctuation (4.69 mbgs at MW 101 on May 13, 2019).
Lowest Finish Floor Elevation		110.11 masl	Based on the architectural drawings (Audax, 2020)
Lowest Footing Elevation		108.61 masl	Assumed to be 1.5 m below the lowest slab elevation
Dewatering Target Elevation	Short-Term	107.61 masl	Assumed to be approximately 1 m below the lowest footing elevation.
	Long-Term	109.61 masl	Assumed to be approximately 0.5 m below the lowest slab elevation
Bottom of Water-Bearing Zone		105.00 masl	Comparing the regional subsurface geology of the Site with the lowest footing elevation indicates that the lowest footing elevation to be installed within Sunnybrook Formation, therefore it is assumed that the bottom of the water-bearing zones is consistent with the top elevation of Scarborough Formation (refer to section 2.1.2).
Excavation Area		~3,157 m^2 (77 m x 41 m)	Based on the architectural drawings (Audax, 2020)
Hydraulic Conductivity (K)		1.5 x 10^{-6} m/s	Highest K value estimated for overburden

4.1.1 Dewatering Flow Rate Estimates (Short-Term and Long Term)

To estimate both, the groundwater flow rates in an open excavation during the construction phase (short-term) and future sub-drain with an open shoring system (soldier pile and lagging) during the post-construction phase, the Dupuit-Forcheimer equation was utilized, which is applicable for steady-state radial flow to the sides of a fully-penetrating excavation in an unconfined aquifer resting on a horizontal impervious surface. The dewatering flow rate according to Dupuit-Forcheimer's analytical solution is expressed as follows:

$$Q_w = \frac{\pi K\ (H^2 - h^2)}{Ln\ \left[\frac{R_o}{r_e}\right]}$$

$$r_e = \frac{a + b}{\pi}$$

Where:

Qw = Rate of pumping (m^3/sec)
K = Hydraulic conductivity (m/sec)
H = Saturated thickness of water-bearing zone beyond the influence of pumping (static groundwater elevation) (m)
h = Saturated thickness above the base of water-bearing zone in an excavation (m)
Rs = Sichardt Radius of influence (m)
Ro = Radius of influence (m) (Ro=Rs+re)
a, b = Sides of excavation (m)
re = Equivalent well radius (m)

During the construction phase (short-term), it is expected that the initial dewatering rate will be higher in order to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, primarily from storage resulting in lower seepage rates into the excavation.

4.1.2 Sichardt's Radius of Influence (Short-Term and Long-Term)

The Sichardt's equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This empirical formula was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

The estimated radius of influence (Ro) of pumping based on the Sichardt formula is expressed as follows:

$$\mathrm{R_s} = C(H - h)\sqrt{(K)}$$

Where:

Rs = Estimated radius of influence (m)
H = Saturated thickness of water-bearing zone (static water level) (m)
h = Dynamic water level above the base of water-bearing zone (m)
K = Hydraulic conductivity (m/sec)
C = Constant 3,000 (unitless)

4.1.3 Stormwater

During the construction phase, additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing stormwater from the excavation. A 15 mm precipitation event was utilized to estimate the additional water volume.

It is noted that a two (2) year storm event over a 24-hour period is approximately 57 mm. During large precipitation events, the water should be retained onsite to conform the allowable water taking and discharge limits, as permitted.

4.2 Estimated Dewatering Rates (Short-Term and Long-Term) and Associated Water-Taking Permits

4.2.1 Construction Phase (Short-Term)

Based on the assumptions provided in this report, the estimated construction dewatering rates are summarized in Table 4-2. The dewatering calculations are provided in Appendix E.

The peak dewatering flow rates account for accumulation of some precipitation, seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, and variation in hydrogeological properties beyond those encountered during this study. Further, the peak dewatering flow rates provide additional capacity for the dewatering contractor.

It is noted that the maximum flow rate, which was calculated with the highest K value, provides conservative estimate to account for higher than expected flow during the construction dewatering. It is the responsibility of the contractor to ensure that dry conditions are always maintained within the excavation at all costs.

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is anticipated to be more than 50 m^3/day but less than 400 m^3/day, an application for the Environmental Activity and Sector Registry (EASR) with MECP will be required. If onsite groundwater dewatering rates exceed 400 m^3/day, a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

Table 4-2 Summary of Construction Dewatering Estimates (Short-Term) and Associated Water-Taking Permits

Location	Proposed Levels Below Grade	Dewatering Rate (m^3/day)		Water-Taking Permits to be Obtained from MECP
		With Rain Collection Volume and Without Safety Factor	With Rain Collection Volume and Safety Factor	
Site Extent	3	135	220	EASR

Based on the assumptions of this report, it is inferred that the radius of influence (Ro) due to construction dewatering activities can grow up to 70 meters from the sides of the excavation.

Pressure relief wells may be required to depressurize the sand seams to mitigate basal heave during excavation, subject to the geotechnical engineer's recommendations.

4.2.2 Post-Construction Phase (Long-Term)

Based on the assumptions provided in this report, the result of the sub-drain discharge volume estimate is preliminary and summarized in Table 4-3. The dewatering calculations are provided in Appendix E. It should be noted that the long-term dewatering flow estimate indicates an averaged discharge volume. The estimated volume must be confirmed once the sub-drain system (s) is operational. Seasonal and daily fluctuations are expected. These estimates may be affected by hydrogeological conditions beyond those encountered at this time, fluctuations in groundwater regimes, surrounding site alterations, and existing and future infrastructures. Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications. A safety factor was applied to the flow rate to accommodate the variability in seasonal water level fluctuations.

It is noted that the estimated volume is considered preliminary. Additionally, it should be noted that the estimated sub-drain discharge volume is based on the assumptions outlined in this report, and that any variations in hydrogeological conditions beyond those encountered as part of this investigation may significantly influence the sub-drain discharge volume. As a result, the exact discharge rate will be confirmed once the sub-drain system (s) is operational. It is recommended that once the sub-drain system(s) is in place, that a flow meter be installed at the sump (s) to record daily discharge volumes to provide more representative estimates during the commissioning stage of the system.

In accordance with the Ontario Water Resources Act, if the water taking for the post-construction dewatering will be more than 50 m^3/day, application for a Category 3 Permit to Take Water (PTTW) would be required from the MECP. Individual PTTW will be required for each underground structure where rates exceed the 50 m^3/day.

For designing a watertight foundation without perimeter and foundation drainage systems, shallow wells are required to assess the shallow groundwater table and the hydrostatic pressure.

Pressure relief wells may be required to depressurize the sand seams to mitigate basal heave, subject to the geotechnical engineer's recommendations.

Table 4-3 Summary of Post-Construction Dewatering Estimates (Long-Term) and Associated Water-Taking Permits

Location	Proposed Levels Below Grade	Dewatering Rate for Sub-Drain System (m^3/day)	Water-Taking Permits to be Obtained from MECP
Site Extent	3	140	Category 3 PTTW

5 Environmental Impact

5.1 Surface Water Features

The Site is located within the watershed of the Don River. No surface water bodies are located onsite.

The nearest surface water feature is Yellow Creek, a tributary of the Don River, which lies approximately 600 meters northeast of the Site boundary. The Lake Ontario is approximately 4.5 km from the Site boundary to the southeast.

Due to the limited extent of zone of influence and the distance of the nearest surface water feature, no impacts to surface water features are expected during construction activities.

5.2 Groundwater Sources

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the number of water supply wells present within a 500 m radius of the Site boundaries. No dewatering related impact is expected on water supply wells, as there are no records of water supply wells in the area.

5.3 Geotechnical Considerations

Under certain conditions, dewatering activities can cause settlements due to an increase in the effective stress in the dewatered soil.

A letter related to geotechnical issues (i.e. settlement) as it pertains to the Site is recommended to be completed under a separate cover.

5.4 Groundwater Quality

It is our understanding that the potential discharge from the dewatering system during the construction will be directed to the municipal sewer system. As such, the quality of groundwater discharge is required to conform the City of Toronto Sewer Use By-Law.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed the both Sanitary and Storm By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

For the long-term dewatering discharge to the City of Toronto's Sewer system (post-development phase), and based on the water quality test results, the water is suitable to be discharged into the Sanitary Sewer system without using a treatment system. However, the water is not suitable to be discharged into the Storm Sewer system without using an appropriate pre-treatment system, as required.

It is noted that the water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. As such, regular water quality monitoring is recommended for the post-construction phase, as required by the City of Toronto. Dewatering (short and long term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was carried out under static conditions. As a result. monitoring may be required during dewatering activities (short and long term) to examine potential migration, and this should be performed more frequently during early dewatering stages.

5.5 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

6 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation, the following conclusions and recommendations are provided:

- The laboratory CofA showed that all parameters conform the Sanitary and Combined Sewer Use By-Law limits (Table 1 of the By-Law).
- When compared to the Storm Sewer Use By-Law Limits (Table 2), the CofA concentrations of Total Suspended Solids (TSS), Total Manganese (Mn) and Total Zinc (Zn) were reported above the Storm Sewer Use By-Law criteria.
- Based on the assumptions outlined in this report, the estimated peak dewatering pumping rate for proposed construction activities is approximately 220 m^3/day. As the dewatering flow rate estimate is between 50 m^3/day and 400 m^3/day, an EASR would be required to facilitate the construction dewatering program for the Site.
- The preliminary long-term flow rate of the foundation sub-drain is estimated to be approximately 140 m^3/day. The exact volume discharged can be confirmed once the system is operational. It is recommended that once the sub-drain system is in place, a flow meter be installed at the sump(s) to record daily discharge volumes to provide more representative estimates during the commissioning stage of the system. Regular maintenance/cleaning of the sub-drain system is recommended to ensure its proper operation. A Category 3 PTTW would be required for the long-term discharge.
- The estimated construction dewatering and long-term dewatering volumes are based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the discharge volumes.
- For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed the both Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.
- For the long-term dewatering discharge to the City of Toronto's Sewer system (post-development phase), and based on the water quality test results, the water is suitable to be discharged into the Sanitary Sewer system without using a treatment system. However, the water is not suitable to be discharged into the Storm Sewer system without using an appropriate pre-treatment system, as required.
- Pressure relief wells may be required to depressurize the sand seams to mitigate basal heave, subject to the geotechnical engineer's recommendations.
- The wells installed as part of this investigation assessed a deep groundwater level (piezometric level) and not the first groundwater table. For the design of water foundations without perimeter and foundation drainage systems, shallower wells will be required to evaluate the shallow groundwater table, and the hydrogeologist needs to be consulted during the design process.
- It is recommended that borehole investigation be conducted on the eastern part of the property to assess the presence of an aquifer in that portion of the site.
- It is noted that an agreement to discharge into the sewers owned by the City of Toronto will be required prior to releasing dewatering effluent.
- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. They assume that the present design concept described throughout the report will proceed to construction. This report is solely intended for the construction and long-term dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

7 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately if any unforeseen Site conditions are experienced during construction activities. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of 1140 Yonge Inc. This report may not be reproduced in whole or in part, without the prior written consent of EXP, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.

Peyman Sayyah, M.Sc., P.Geo.
Senior Hydrogeologist
Environmental Services

Reinhard Zapata Blosa, P.Geo, Ph.D.
Senior Hydrogeologist
Environmental Services

Francois Chartier, M.Sc., P.Geo.
Head of Hydrogeology Group
Environmental Services

8 References

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Smith + Andersen

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416 487 8151 f 416 487 9104 smithandandersen.com

2020-08-14

Attention: Executive Director, Engineering and Construction Services
c/o Manager, Development Engineering
5100 Yonge Street, 4th floor.
Toronto, Ontario, M2N 5V7

cc: General Manager, Toronto Water
c/o Manager, Environmental Monitoring and Protection Unit
30 Dee Avenue
Toronto, Ontario, M9N 1S9

RE: **1140 YONGE STREET**
TORONTO, ONTARIO
S+A PROJECT # 19263.002.M001
GROUND WATER DISCHARGE STRATEGY

To whom it may concern:

This letter is to confirm that groundwater from the Private Water Drainage System for the above mentioned project will be collected and discharged into the sanitary control manhole of the site located at 1140 Yonge Street.

The groundwater sump pumps will be sized at 2.21 L/sec (groundwater peak flow rate) and are expected to run approximately 17.6 hours per day.

This peak flow rate will be used for assessing capacity for the peak discharge flow into the City's sanitary sewer system.

Once the proposed groundwater peak flow rate of 2.21 L/sec is approved by Engineering Construction Services (ECS), City of Toronto, the property owner will not be allowed to amend this flow rate in the future. Should there be any amendment to the peak flow rate of 2.21 L/sec in future, the property owner shall re-submit either the updated pump schedule or a revised letter to ECS. In addition, the sewer capacity will need to be re-assessed.

Smith + Andersen

Bram Atlin P.Eng., LEED AP
Principal
d 416 218 7045 m 416 895 9825
bram.atlin@smithandandersen.com
19263.002.m.001.l001 (Ground Water Approach)

Appendix D

Counterpoint Engineering Inc.

Project: 1140 Yonge Street
Project No: 18072
Location: Toronto, Ontario
Site Area: 0.287 ha

Existing Equivalent Population Calculations

As per Design Criteria for Sewers and Watermains - First Edition November 2009 City of Toronto

Design flow = average daily dry weather flow x peaking factor + infiltration

Persons Per Unit and per Land Use

Single Family Dwelling	3.5	ppu
1BR/1BR+Den	1.4	ppu
2BR/2BR+Den/	2.1	ppu
3BR/3BR+Den	3.1	ppu
Commercial / Retail	1.1	persons/100m^2
Offices	3.3	persons/100m^2

	Commercial Units	
	# of Floors	**Area (m^2)**
Existing Commercial	0	**1928**

	TOTAL UNITS	PERSONS PER UNIT	TOTAL POPULATION
Commercial	-	-	21
Residential Average flow	2	2.1	4
Total Equivalent Population			**25**

Peak flow Design Parameters

Residential Average flow	240	litres/person/day
Commercial Average flow	250	litres/person/day
Infiltration	0.26	litres/second/ha

Harmon Peaking Factor

PF = 1 + (14/(4+(P/1000)$^{1/2}$))

Total Population	Harmon Peak Factor
4	**4.44**

Average Commercial Dry Weather Flow	0.06	**L/s**
Peak Residential Flow	0.05	**L/s**
Infiltration	0.07	**L/s**
Flow	**0.19**	**L/s**

Counterpoint Engineering Inc.

Project: 1140 Yonge Street
Project No: 18072
Location: Toronto
Site Area: 0.273 ha

Proposed Sanitary Flow Calculations

As per Design Criteria for Sewers and Watermains - First Edition November 2009 City of Toronto

Design flow = average daily dry weather flow x peaking factor + infiltration

Persons Per Unit and per Land Use

1BR/1BR+Den	1.4	ppu
2BR/2BR+Den/	2.1	ppu
3BR/3BR+Den	3.1	ppu
Townhouses	2.7	ppu
Commercial / Retail	1.1	persons/100m^2
Offices	3.3	persons/100m^2

	Residential Units					Commercial
	1B / 1B+D	2B / 2B + D	3B / 3B+D	Townhouses	Total Units	Area (m^2)
Level 1 - 13	11	43	9	3	66	**1441**
TOTAL UNITS / AREA (m^2)	**11**	**43**	**9**	**3**	66	**1441**

	Population 1BR / 1B + D	Population 2BR / 2BR + D	Population 3BR / 3BR + D	Townhouse Population	Population Commercial	TOTAL POPULATION
Residential	16	91	28	8		135
Commercial					16	16
Total Equivalent Population						**151**

Peak flow Design Parameters

Residential Average flow	240	litres/person/day
Commercial Average flow	180,000	litres/ha/day
Infiltration	0.26	litres/second/ha

Harmon Peaking Factor

PF = 1 + (14/(4+(P/1000)$^{1/2}$))

Residential Population	Harmon Peak Factor
135	**4.21**

Residential Flow	1.58	**L/s**
Commercial Flow	0.30	**L/s**
Groundwater Flows	2.21	**L/s**

*based on 40 USGPM pump

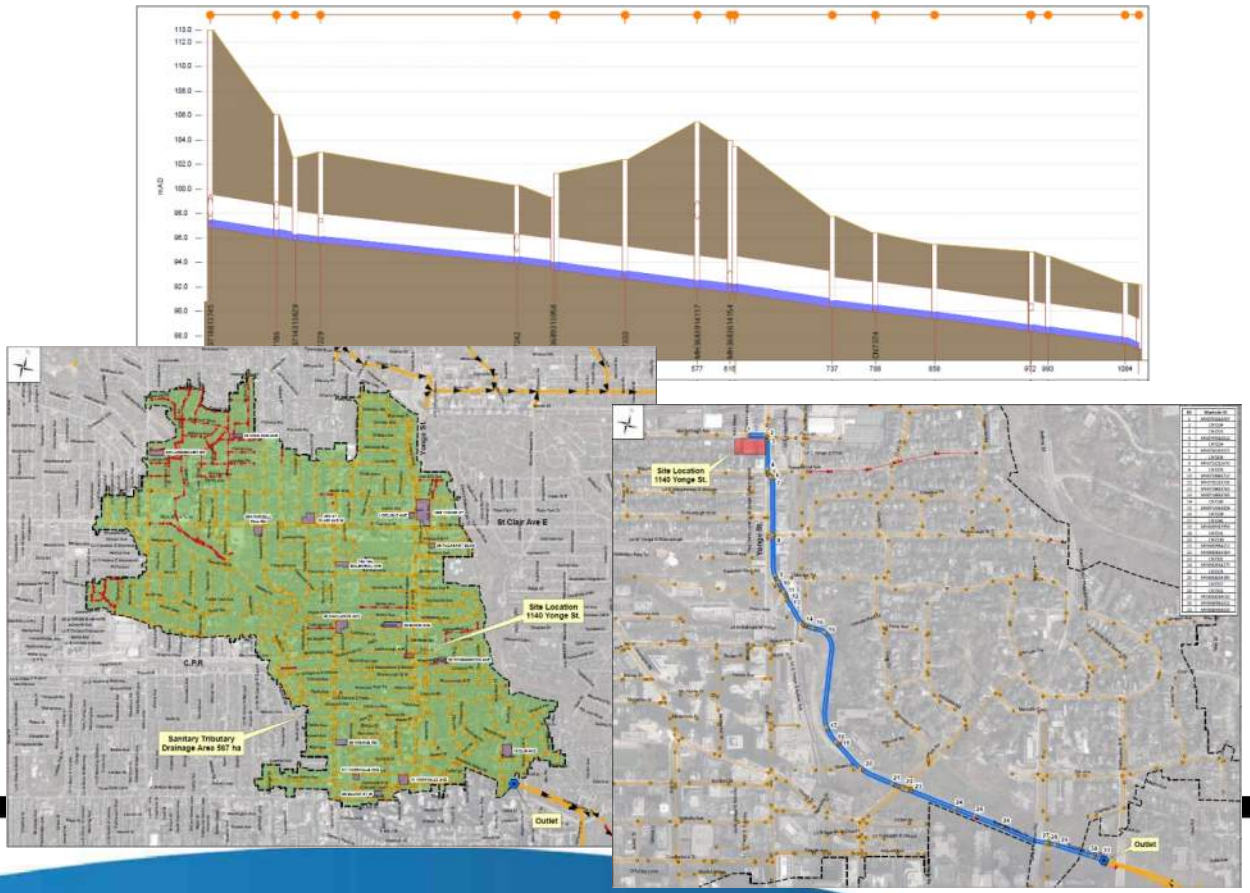
Flow	**4.09**	**L/s**

Counterpoint Engineering Inc.

Civica Reference: COU19-0128

1140 Yonge Street Combined Sewer Capacity Analysis

February 20, 2020



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The attached Report (the "Report") has been prepared by Civica Infrastructure Inc. (the "Consultant") at the request of, and for the exclusive use of, the client (the "Client") in accordance with the terms of agreement between the Consultant and the Client, including the scope of work detailed therein (the "Agreement").

Please note that the information, data, analysis, recommendations, and conclusions contained in the Report was prepared for the specific purposes described in the Report and the Agreement and may be based upon information which has not been independently verified by the Consultant. The Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to the Consultant, and has no obligation to update such information. The material in this report reflects the Consultant's best professional judgement in the light of the information available to it at the time of preparation and publication.

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February 20, 2020

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100
Vaughan, ON
L4K 5Y2

CIVICA Ref: COU19-0128.

Attention: Rasheed Serrao, P.Eng.

Dear Mr. Serrao,

RE: 1140 Yonge Street Combined Sewer Capacity Analysis, City of Toronto

Civica Infrastructure Inc. (Civica) is pleased to submit the Sanitary Capacity Analysis in support of the proposed development on 1140 Yonge Street, in the City of Toronto. An InfoWorks ICM model was used to assess the existing and proposed conditions of the sanitary sewer downstream of the proposed site.

Existing Conditions

The existing condition model was updated to include the new development applications in the drainage area since the model was updated in 2018. The 0.52 L/s desing peak flow from the existing site discharge to the 375 mm combined sewer on Marlborough Avenue. The downstream combined sewer operates under free-flow conditions during both dry- and wet-weather flow conditions.

Proposed Conditions

Under post-development conditions, the proposed sanitary flows will be connected to the same 375 mm combined sewer on Marlborough Avenue. The expected sanitary peak flow from the proposed re-development site is 3.27 L/s. This amounts a net increase of 2.75 L/s compared to existing condition. The downstream combined sewer operates under free-flow conditions during both dry- and wet-weather flow conditions.

Conclusion

Based on the analysis and assumptions presented in the report, the existing combined sewer system has the capacity to accommodate the proposed dry- and wet weather flows while maintaining free-flow conditions. The existing municipal combined sewer system can support the proposed development site without the need for external upgrades or retrofits.

Do not hesitate to contact us for further clarification and/or comment.

Sincerely,

CIVICA INFRASTRUCTURE INC.

Alan Villalobos
Project Manager

Encl. 1140 Yonge Street Combined Sewer Capacity Analysis

Disclaimer

The data used for this analysis has been obtained from City of Toronto sources with the understanding that these are provided without warranties. This data is included in the hydrodynamic model. The information has been reviewed to ensure consistency with general sanitary sewer system modeling principles used in the City of Toronto. Unless noted in this memo, specific sewer system geometric characteristics and operating conditions have not been verified in the field or by cross-referencing with As-Built drawings or other sources that may be available from the City of Toronto.

Document History & QA/QC

Prepared by:

Alan Villalobos
Project Manager
Civica Infrastructure Inc.

Reviewed by:

Edward Graham, M.A.Sc.Eng., P.Eng.
President
Civica Infrastructure Inc.

Revision History

Name	Date	Reason for Change	Version
Alan Villalobos	**2020-02-20**	**First draft**	**Version 1**

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Appendix A – Model Results

1.0 Introduction

This memo summarizes the sanitary servicing analysis for the proposed 0.28 ha re-development site located at 1140 Yonge Street, in Toronto. The capacity conditions in the existing combined sewer system has been evaluated from the proposed site to the downstream outlets on Rosedale Valley Road west of the Sherbourne Street North bridge.

1.1 Servicing Connections

The sanitary flows from the existing site are currently connected to the 375-mm combined sewer on Marlborough Avenue that conveys flows east connecting to a 750 x 1200-mm egg shaped combined sewer flowing south on Yonge Street and then east on Aylmer Avenue. From here the sewer goes east as Rosedale Valley Road winds it way through Rosedale Valley, out-letting to the trunk sewer on Rosedale Valley Road west of the Sherbourne Street North bridge. The proposed sanitary flows will also be connected to the 375-mm circular shaped combined sewer.

The storms flows from the existing site are currently connected to the same 375-mm combined sewer on Marlborough Avenue which conveys flows east. The proposed storm flows will also be connected to the 375-mm circular shaped combined sewer.

1.2 Capacity Analysis Approach

The sewer capacity after redevelopment has been quantified using an InfoWorks ICM developed using the City of Toronto's BPR InfoWorks ICM model as a baseline. We understand that the City's BPR model was developed and calibrated in 2014 to assess the performance of the City's Trunk Sewers. This model was updated in 2018 to assess the combined sewer capacity in support of the site plan application for 155 Balmoral Avenue.

For this analysis, the drainage system was evaluated to include new and other proposed developments/re-developments in the area since the model was updated in 2018. Sixteen (16) new development applications were found in the drainage area since 2018. **Table 1** shows the new developments which have be incorporated into the model to account for 'existing conditions'.

Figure 1 shows the location of the site, the new developments, and the tributary area. **Figure 2** shows the combined sewers downstream of the proposed development to the study outlet.

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Table 1: New Developments Since 2018

No.	Site Address	Residential Population	Residential Peak Flow (L/s)	Non-Residential Peak Flow (L/s)	Peak Inflow and Infiltration (L/s)	Total Peak Flow (L/s)
1	111 Yorkville Ave	0	0.00	0.94	0.01	0.95
2	1 Delisle Ave	533	5.86	7.09	0.06	13.01
3	10 Elm Ave	0	0.00	0.86	0.31	1.17
4	11 Yorkville Ave	1189	12.39	10.37	0.08	22.84
5	80 Bloor St W	2371	23.23	25.41	0.07	48.71
6	40 Oaklands Ave	0	0.00	0.00	0.16	0.16
7	260 Russell Hill Rd	78	0.93	1.43	0.11	2.46
8	29 Pleasant Blvd	552	6.06	4.42	0.04	10.52
9	26 Birch Ave	66	0.79	1.43	0.07	2.29
10	1485 Yonge St	2345	23.00	29.50	0.36	52.86
11	34 Coulson Ave	7	0.09	0.03	0.15	0.27
12	32 Rowanwood Ave	25	0.30	0.24	0.01	0.55
13	202 St Clair Ave W	167	1.94	2.73	0.08	4.75
14	145-155 Balmoral Ave	212	2.44	3.16	0.07	5.67
15	89 Avenue Rd	102	1.20	1.71	0.03	2.94
16	244 Lonsmount Dr	16	0.20	0.25	0.02	0.46

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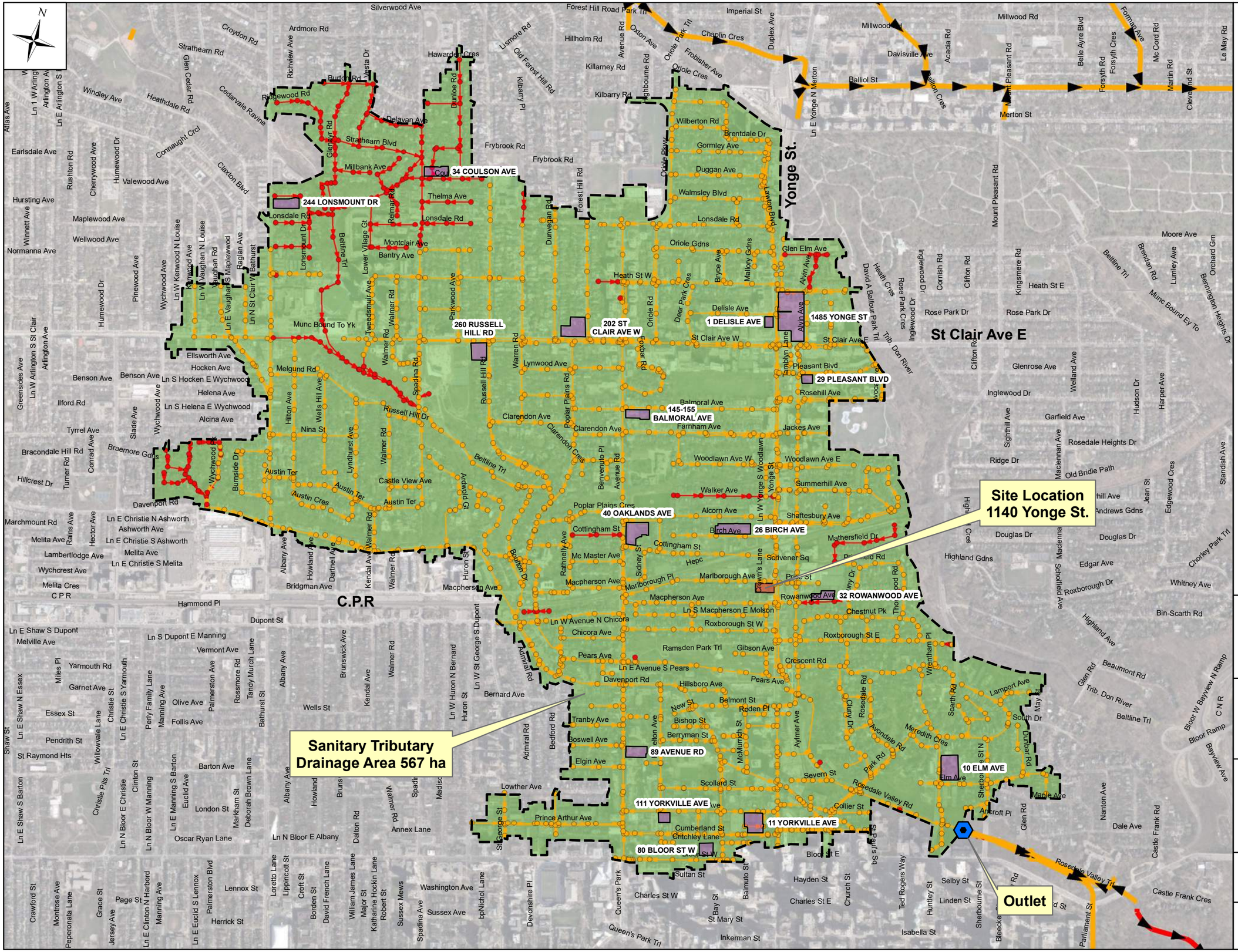

Legend

- Outlet
- **Manholes**
  - Sanitary
  - Combined
- **Sewers**
  - Sanitary
  - Combined
- **Trunk Sewers**
  - Sanitary
  - Combined
- Sanitary Tributary Drainage Area
- Site Location
- New Developments

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COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 1: Sanitary Tributary Drainage Area

Drawn By: J.H. Date: Feb 20, 2020

0 125 250 500 Meters

ID	Manhole ID
1	MH3754213547
2	CN7194
3	CN7213
4	MH3747013612
5	CN7214
6	MH3746313615
7	CN7204
8	MH3732213670
9	CN7205
10	MH3721913717
11	MH3720113736
12	MH3719613741
13	MH3718813745
14	CN7186
15	MH3714313829
16	CN7229
17	CN7242
18	MH3689313958
19	CN7241
20	CN7330
21	MH3683914117
22	MH3683614154
23	CN7382
24	MH3682614275
25	CN7374
26	MH3681614396
27	CN7357
28	CN7302
29	MH3681014530
30	MH3680914621
31	MH3680414639

Legend

- Outlet
- **Manholes**
  - Sanitary
  - Combined
- **Sewers**
  - Sanitary
  - Combined
- **Trunk Sewers**
  - Sanitary
  - Combined
- Downstream Combined Sewer Conveyance Flow
- Sanitary/Combined Tributary Drainage Area
- Site Location

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COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 2: Downstream Combined Sewer Conveyance Flow

Drawn By: J.H. Date: Feb 20, 2020

0 50 100 200 Meters

2.0 Design Sanitary Flows

2.1 Existing Sanitary Flows

The flow generation for the existing site has been obtained from City of Toronto's BPR InfoWorks ICM model. The breakdown flow generation calculation for the combined sewer under existing conditions is presented below. The total flow into the combined sewer was calculated to be 0.52 L/s.

1) Site Area = **0.28 ha**

2) Criteria for existing development:

Flow generation rate (from BPR model) =	250 L/c/d
Harmon peaking factor =	1 + 14 / [4+(Pop/1000)^0.5]
Infiltration allowance =	0.26 L/s/ha

3) Existing Population:

Population =	**52 person**
Harmon peaking factor (Maximum 3.0) =	**3.0**

4) Sanitary DWF to the combined sewer:

DWF = Population x Average daily flow x Harmon PF / 86400 sec/d
DWF = 52 people x 250 L/c/d x 3.0 / 86400 = **0.45 L/s**

5) Infiltration allowance contributing to the sanitary sewer:

I/I = Area x Inf. Rate
I/I = 0.28 ha x 0.26 L/s/ha = **0.07 L/s**

6) Total flow into the sanitary sewer under existing condition = Dry Weather Flow + Infiltration allowance flow:

Peak Flow = 0.45 + 0.07 **0.52 L/s**

2.2 Proposed Sanitary Flows

The flow generation parameters for the site are re-calculated in accordance to the City's criteria manual (DCSW). The expected sanitary peak flow from the proposed re-development site is 3.27 L/s. This amounts a net increase of 2.75 L/s compared to existing conditions.

1) Area:

Site Area = **0.28 ha**

2) Criteria for new developments:

Sanitary flow generation rates =	240 L/c/d
Harmon Peaking Factor =	1 + 14 / [4+(Pop/1000)^0.5]
Infiltration allowance =	0.26 L/s/ha

3) Population = **146 persons**

4) Peaking Factor = **4.19**

5) Sanitary DWF:

Residential = Population x Average daily flow x Harmon PF / 86400 sec/d
Residential = 146 people x 240 L/c/d x 4.19 / 86400 = **1.70 L/s**

6) Groundwater Flow:

Peak pump rate = **1.5 L/s**

7) Infiltration allowance contributing to the sanitary sewer:

I/I = Area x Inf. Rate
I/I = 0.28 ha x 0.26 L/s/ha = **0.07 L/s**

8) Total flow into the sanitary sewer = Dry Weather Flow + Infiltration Allowance + Groundwater Peak Flow:

Peak Flow = 1.70 L/s + 0.07 L/s + 1.5 L/s = **3.27 L/s**

3.0 Methodology for Total System Flow and Hydraulic Gradeline Analysis

When calculating the total flow and resulting hydraulic gradelines (HGL) in the sewer system, the population in the existing upstream and downstream areas were estimated using Toronto's BPR InfoWorks ICM model. The flow generation from the various tributary areas upstream and downstream from the site were calculated using InfoWorks ICM hydrodynamic model.

The per capita dry-weather flow generation in the model varies from 240 L/c/d to 253 L/c/d. We understand that this value was calibrated based on the flow measurements by the City of Toronto (or their consultants). For existing and proposed conditions, the model assumes an institutional sewage generation rate of 250 L/c/d.

The runoff coefficient used in the model over impervious surfaces varies from 0.9 to 1.0. The model varies the initial loss (or initial abstraction) values and slopes according to the local conditions. Runoff over pervious areas is calculated using Horton's infiltration method.

4.0 Results

4.1 Dry-Weather Flow (DWF)

Figure 7A, 7B and **Figure 8A, 8B** show the HGL under DWF conditions for both pre- and post-development conditions. **Figure 3** and **Figure 5** show the downstream flow conditions for both pre- and post-development conditions. **Table 2** and **Table 3** summarize the peak flows and water levels (HGL) under the pre- and post-development conditions.

Under the dry weather flow, the findings can be summarized as follows:

- Under existing and proposed conditions, the combined sewer system operates under free-flow conditions.

- Under proposed conditions, the peak flow immediately downstream of the propose re-development site at manhole MH3754213547, increases 2.7 L/s from 3.3 L/s to 6.0 L/s.
- Under proposed conditions, the HGL at the manhole downstream of the propose re-development site (MH3754213547) increases 0.011 m from 117.127 m to 117.138 m.
- Under proposed conditions, the peak flow at the study outlet increases 2.5 L/s, from 888.7 L/s to 891.2 L/s.
- Under proposed conditions, the HGL at the study remains the same as existing conditions; 87.669 m.

4.2 Dry-Weather Flow (DWF) + Extreme Wet Weather Flow Runoff

The extreme wet-weather flow analysis combines DWF with the infiltration allowance and the runoff surface contributions for the 1 in 100-year storm flows from the site.

Peak flows and HGL elevations in the combined sewer are listed in **Table 2** and **Table 3**. **Figure 9A, 9B** and **Figure 10A, 10B** show pre- and post-development HGL profile in the combined sewer during the 100-yr design storm. **Figure 4** and **Figure 6** show the downstream flow conditions for both pre- and post-development conditions.

- Under existing and proposed conditions, the combined sewer system operates under free-flow conditions.
- Under proposed conditions, the peak flow immediately downstream of the propose re-development site at manhole MH3754213547 increases 2.2 L/s; from 46.0 L/s to 48.2 L/s.
- Under proposed conditions, the HGL at the manhole downstream of the propose re-development site (MH3754213547) increases 0.003 m from 117.238 m to 117.241 m.
- Under proposed conditions, the peak flow at the study outlet increases 7.2 L/s from 4,604.8 L/s to 4,612.0 L/s.
- Under proposed conditions, the HGL at the outlet manhole remains the same as existing conditions; 87.846 m.
- Note that the peak flow from the proposed site may not happen at the same time that the peak flow from the tributary area upstream.
- Timing at flow junctions may cause minor differences in peak flow and HGL downstream of the proposed site.
- Under proposed conditions the HGL downstream of the subject site will increase as compared to existing conditions.

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Table 2: Existing and proposed peak flows downstream of the proposed development site

Street Name	US node ID	DS node ID	Length (m)	Dimension (mm)	US invert level (m)	DS invert level (m)	Slope (m/m)	Pipe capacity (L/s)	DWF				DWF + 100-yr Storm			
									Existing		Proposed		Existing		Proposed	
									Max DS flow (L/s)	Surcharge State[1]	Max DS flow (L/s)	Surcharge State[1]	Max DS flow (L/s)	Surcharge State[1]	Max DS flow (L/s)	Surcharge State[1]
Marlborough Ave	MH3754213547	CN7194	44.6	375	117.081	116.834	0.0055	131	3.3	0.1	6.0	0.2	46.0	0.4	48.2	0.4
Yonge St	CN7194	CN7213	7.2	750 x 1200	116.681	116.504	0.0246	2995	3.6	0.1	6.4	0.1	48.6	0.1	50.8	0.2
	CN7213	MH3747013612	74.8	750 x 1200	116.504	114.686	0.0243	2978	7.7	0.1	10.4	0.1	61.6	0.2	63.8	0.2
	MH3747013612	CN7214	4.9	750 x 1200	114.686	114.676	0.0020	863	8.4	0.1	11.2	0.1	64.8	0.2	66.9	0.2
	CN7214	MH3746313615	2.7	750 x 1200	114.676	114.670	0.0022	900	14.4	0.1	17.1	0.1	123.7	0.2	125.8	0.2
	MH3746313615	CN7204	16.1	600	114.670	111.735	0.1823	2622	15.4	0.3	18.2	0.3	126.8	0.7	128.9	0.7
	CN7204	MH3732213670	140.2	1500	111.721	110.632	0.0078	6231	232.9	0.1	235.5	0.1	1082.8	0.3	1084.7	0.3
	MH3732213670	CN7205	95.4	1500	107.123	106.471	0.0068	5845	235.1	0.2	237.8	0.2	1083.7	0.3	1085.6	0.3
	CN7205	MH3721913717	19.2	1500	106.471	106.270	0.0105	7234	235.2	0.2	237.8	0.2	1084.3	0.3	1086.2	0.3
	MH3721913717	MH3720113736	26.2	1500	106.270	100.135	0.2342	34211	235.2	0.1	237.8	0.1	1084.2	0.2	1086.1	0.2
	MH3720113736	MH3719613741	7.2	1500	98.242	97.906	0.0467	15273	235.2	0.2	237.8	0.2	1084.1	0.3	1086.1	0.3
	MH3719613741	MH3718813745	8.6	1500	97.906	97.765	0.0164	9053	242.8	0.2	245.4	0.2	1131.1	0.3	1133.1	0.3
Aylmer Ave	MH3718813745	CN7186	78.4	2700	96.852	96.045	0.0103	34389	562.8	0.1	565.4	0.1	3140.9	0.2	3146.1	0.2
	CN7186	MH3714313829	22.1	2700	96.045	95.818	0.0103	34352	649.2	0.1	651.8	0.1	3655.8	0.2	3659.8	0.2
	MH3714313829	CN7229	30.1	2400 x 2400	95.803	95.587	0.0072	26701	649.2	0.1	651.8	0.1	3655.2	0.2	3659.2	0.2
	CN7229	CN7242	232.9	2400 x 2400	95.587	93.918	0.0072	26682	649.3	0.1	651.9	0.1	3652.1	0.2	3658.1	0.2
	CN7242	MH3689313958	43.1	2400 x 2400	93.918	93.609	0.0072	26688	713.6	0.1	716.2	0.1	3849.0	0.2	3854.7	0.2
	MH3689313958	CN7241	3.8	2700	93.395	93.361	0.0090	32062	713.6	0.1	716.2	0.1	3848.5	0.2	3854.4	0.2
	CN7241	CN7330	81.3	2700	93.361	92.639	0.0089	31942	713.9	0.1	716.5	0.1	3848.6	0.2	3854.5	0.2
	CN7330	MH3683914117	85.6	2700	92.639	91.880	0.0089	31917	715.5	0.1	718.0	0.1	3848.0	0.3	3853.9	0.3
Rosedale Valley Rd	MH3683914117	MH3683614154	38.6	2700	91.880	91.591	0.0075	29329	727.8	0.2	730.3	0.2	3934.4	0.3	3940.6	0.3
	MH3683614154	CN7382	5.7	3000	91.591	91.532	0.0104	45672	863.5	0.1	866.1	0.1	4356.2	0.2	4363.4	0.2
	CN7382	MH3682614275	115.7	3000	91.532	90.353	0.0102	45316	872.5	0.1	875.1	0.1	4421.5	0.2	4428.5	0.2
	MH3682614275	CN7374	51.1	2625 x 2475	90.353	89.964	0.0076	32237	872.5	0.1	875.0	0.1	4420.0	0.2	4427.1	0.2
	CN7374	MH3681614396	70.1	2625 x 2475	89.964	89.430	0.0076	32248	872.5	0.1	875.0	0.1	4416.8	0.2	4423.9	0.2
	MH3681614396	CN7357	113.6	2625 x 2475	89.430	88.393	0.0091	35301	872.6	0.1	875.2	0.1	4417.4	0.2	4424.5	0.2
	CN7357	CN7302	1.1	2625 x 2475	88.393	88.382	0.0100	36948	872.8	0.1	875.3	0.1	4419.0	0.2	4426.1	0.2
	CN7302	MH3681014530	19.8	2625 x 2475	88.382	88.202	0.0091	35229	888.7	0.1	891.2	0.1	4608.5	0.2	4615.8	0.2
	MH3681014530	MH3680914621	91.3	2625 x 2475	88.202	87.369	0.0091	35292	888.7	0.1	891.2	0.1	4605.0	0.2	4612.2	0.2
	MH3680914621	MH3680414639	16.4	2625 x 2475	87.369	86.955	0.0252	58704	888.7	0.1	891.2	0.1	4604.8	0.2	4612.0	0.2

Notes:

[1] Surcharge State is calculated as the ratio of maximum water depth to pipe height and indicates whether the flow rate in the system has exceeded the capacity of the pipe to the extent that levels rise within manholes, i.e. pipe surcharging

Table 3: Existing and proposed HGL in the combined sewer downstream of the site

Street Name	Node ID	Ground Level (m)	DWF				DWF + 100-yr Storm			
			Existing HGL (m)	Proposed HGL (m)	Change in Water Level (m)	Freeboard [1] under Proposed Conditions (m)	Existing HGL (m)	Proposed HGL (m)	Change in Water Level (m)	Freeboard [1] under Proposed Conditions (m)
Marlborough Ave	MH3754213547	121.528	117.127	117.138	0.011	4.390	117.238	117.241	0.003	4.287
Yonge St	CN7194	121.300	116.806	116.809	0.003	4.491	116.846	116.848	0.002	4.452
	CN7213	121.200	116.634	116.637	0.003	4.563	116.678	116.679	0.001	4.521
	MH3747013612	120.013	114.797	114.806	0.009	5.207	114.961	114.964	0.003	5.049
	CN7214	119.300	114.789	114.796	0.007	4.504	114.956	114.958	0.002	4.342
	MH3746313615	119.248	114.738	114.740	0.002	4.508	114.778	114.779	0.001	4.469
	CN7204	119.200	111.931	111.932	0.001	7.268	112.150	112.150	0.000	7.050
	MH3732213670	116.301	107.339	107.339	0.000	8.962	107.564	107.564	0.000	8.737
	CN7205	111.800	106.704	106.705	0.001	5.095	106.892	106.893	0.001	4.907
	MH3721913717	110.080	106.444	106.444	0.000	3.636	106.502	106.502	0.000	3.578
	MH3720113736	109.266	98.439	98.440	0.001	10.826	98.556	98.556	0.000	10.710
	MH3719613741	109.266	98.127	98.128	0.001	11.138	98.296	98.297	0.001	10.969
Aylmer Ave	MH3718813745	113.000	97.211	97.211	0.000	15.789	97.460	97.460	0.000	15.540
	CN7186	106.100	96.414	96.414	0.000	9.686	96.694	96.695	0.001	9.405
	MH3714313829	102.594	96.013	96.014	0.001	6.580	96.317	96.317	0.000	6.277
	CN7229	103.000	95.797	95.798	0.001	7.202	96.101	96.101	0.000	6.899
	CN7242	100.300	94.137	94.137	0.000	6.163	94.445	94.445	0.000	5.855
	MH3689313958	99.296	93.704	93.704	0.000	5.592	94.039	94.039	0.000	5.257
	CN7241	101.300	93.670	93.670	0.000	7.630	94.004	94.005	0.001	7.295
	CN7330	102.400	92.949	92.949	0.000	9.451	93.285	93.286	0.001	9.114
Rosedale Valley Rd	MH3683914117	105.440	92.211	92.211	0.000	13.229	92.566	92.566	0.000	12.874
	MH3683614154	104.000	92.002	92.002	0.000	11.998	92.283	92.283	0.000	11.717
	CN7382	103.500	91.944	91.944	0.000	11.556	92.225	92.226	0.001	11.274
	MH3682614275	97.806	90.591	90.592	0.001	7.214	90.893	90.893	0.000	6.913
	CN7374	96.400	90.202	90.203	0.001	6.197	90.503	90.504	0.001	5.896
	MH3681614396	95.477	89.659	89.660	0.001	5.817	89.947	89.947	0.000	5.530
	CN7357	94.900	88.624	88.624	0.000	6.276	88.920	88.920	0.000	5.980
	CN7302	94.900	88.613	88.614	0.001	6.286	88.910	88.910	0.000	5.990
	MH3681014530	94.500	88.433	88.434	0.001	6.066	88.729	88.730	0.001	5.770
	MH3680914621	92.347	87.669	87.669	0.000	4.678	87.846	87.846	0.000	4.501

Notes:

[1] Freeboard = Distance from the HGL elevation to the ground surface elevation

5.0 Conclusions

Based on the analysis and assumptions presented in the report, the findings can be summarized as follows:

1. The expected sanitary peak flow from the proposed re-development site is 3.27 L/s. This amounts to a net increase of 2.75 L/s compared to existing conditions;
2. The existing sewer system has capacity to accommodate both the dry- and wet-weather flow's while maintaining free-flow conditions;
3. The existing municipal sanitary sewer can support the proposed development site without the need for external upgrades or retrofits.

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Appendix A

Modelling Results

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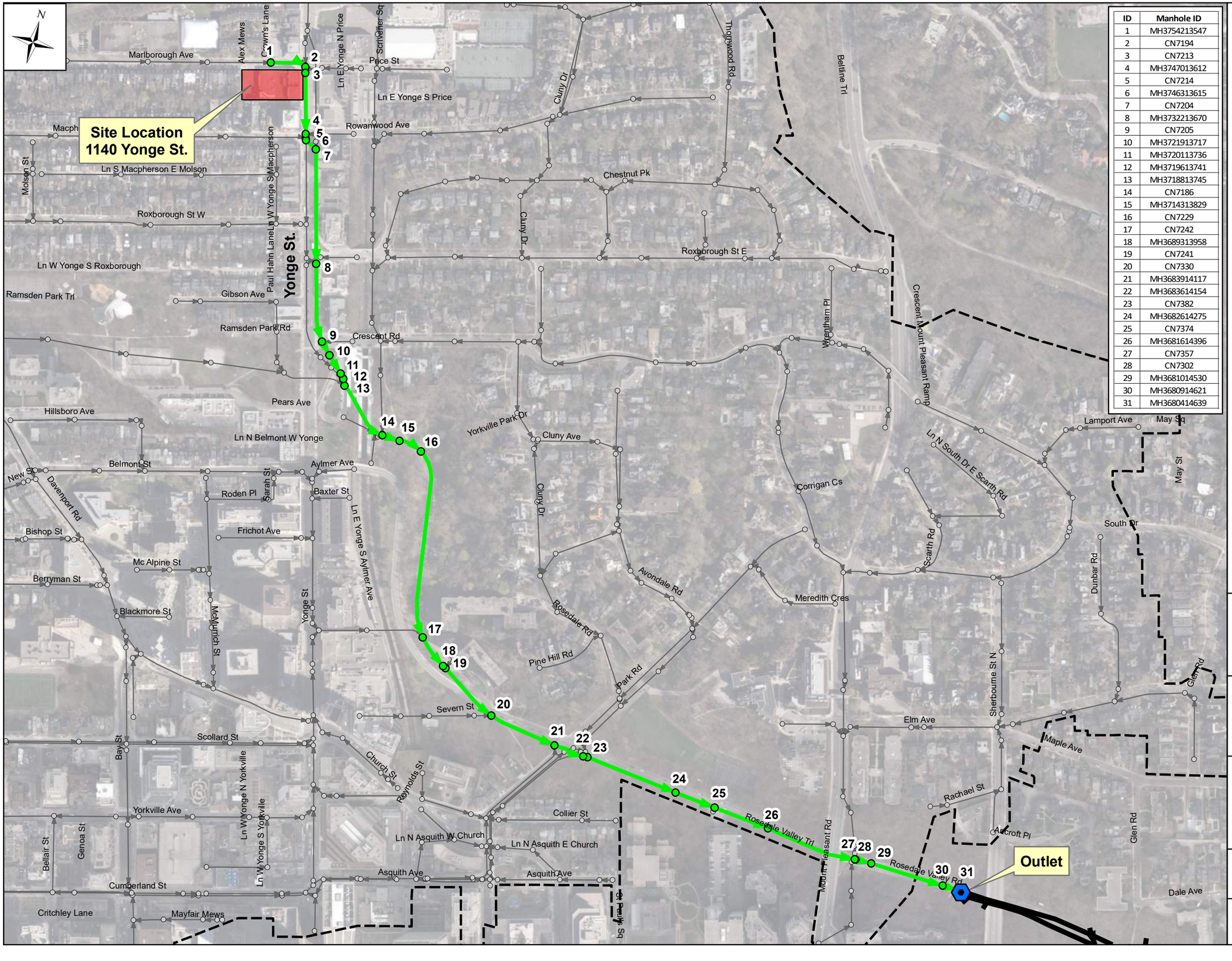

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25	CN7374
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Legend

- Outlet
- Sanitary/Combined Manholes
- Sanitary/Combined Sewers
- Sanitary/Combined Trunk Sewers
- Sanitary/Combined Tributary Drainage Area Boundary
- Site Location

Sanitary/Combined Manholes

- At or Above Surface
- Within Basement Level (0 - 1.8 m)
- Below Basement (> 1.8 m)

Sanitary/Combined Sewers

- Surcharge State=2 (Bottleneck)
- Surcharge State=1 (Backup)
- Within Capacity (No Surcharge)

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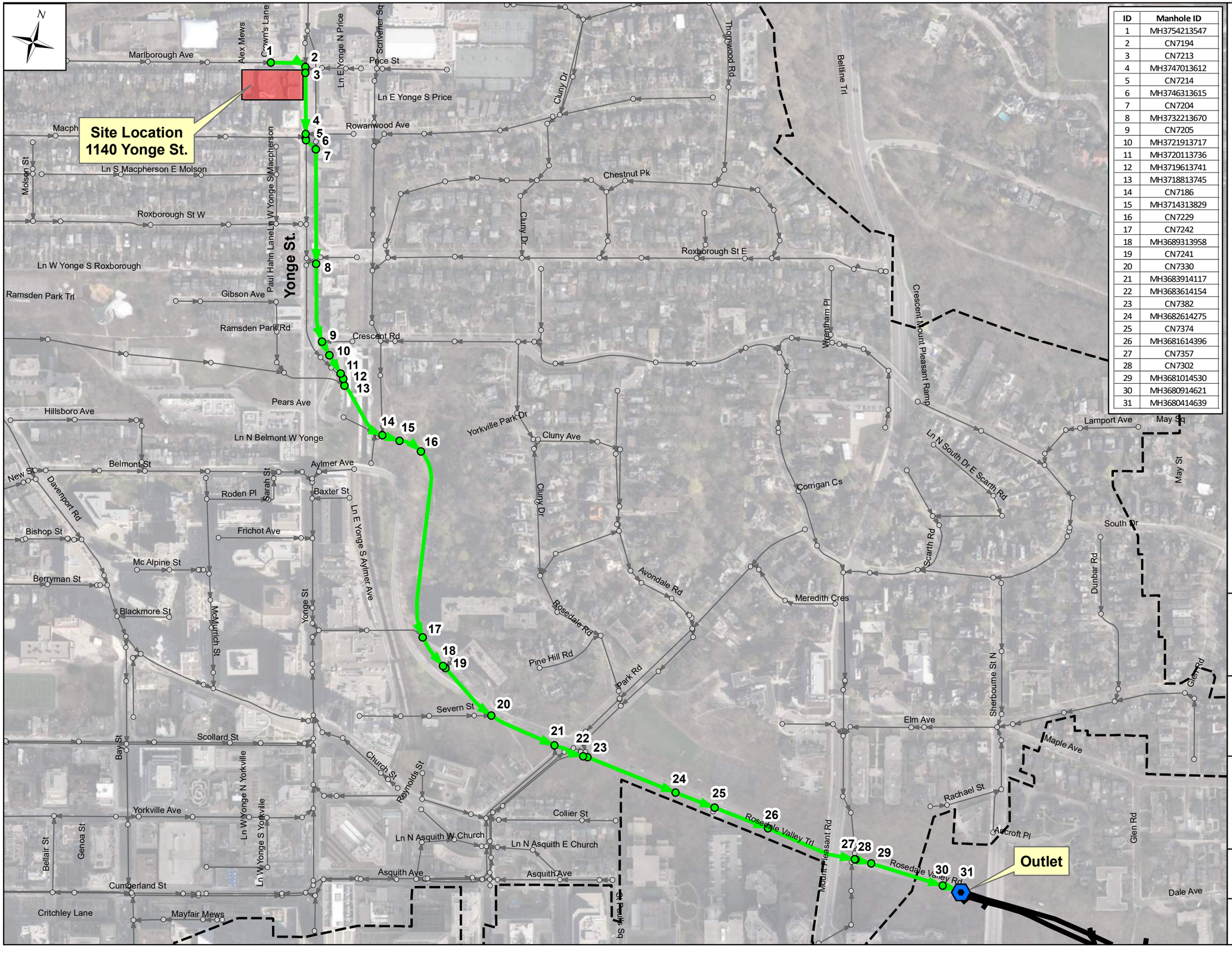
COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 3: Existing Condition DWF Model Results

Drawn By: J.H. Date: Feb 20, 2020

0 50 100 200 Meters



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Legend

- Outlet
- Sanitary/Combined Manholes
- Sanitary/Combined Sewers
- Sanitary/Combined Trunk Sewers
- Sanitary/Combined Tributary Drainage Area Boundary
- Site Location

Sanitary/Combined Manholes

- At or Above Surface
- Within Basement Level (0 - 1.8 m)
- Below Basement (> 1.8 m)

Sanitary/Combined Sewers

- Surcharge State=2 (Bottleneck)
- Surcharge State=1 (Backup)
- Within Capacity (No Surcharge)

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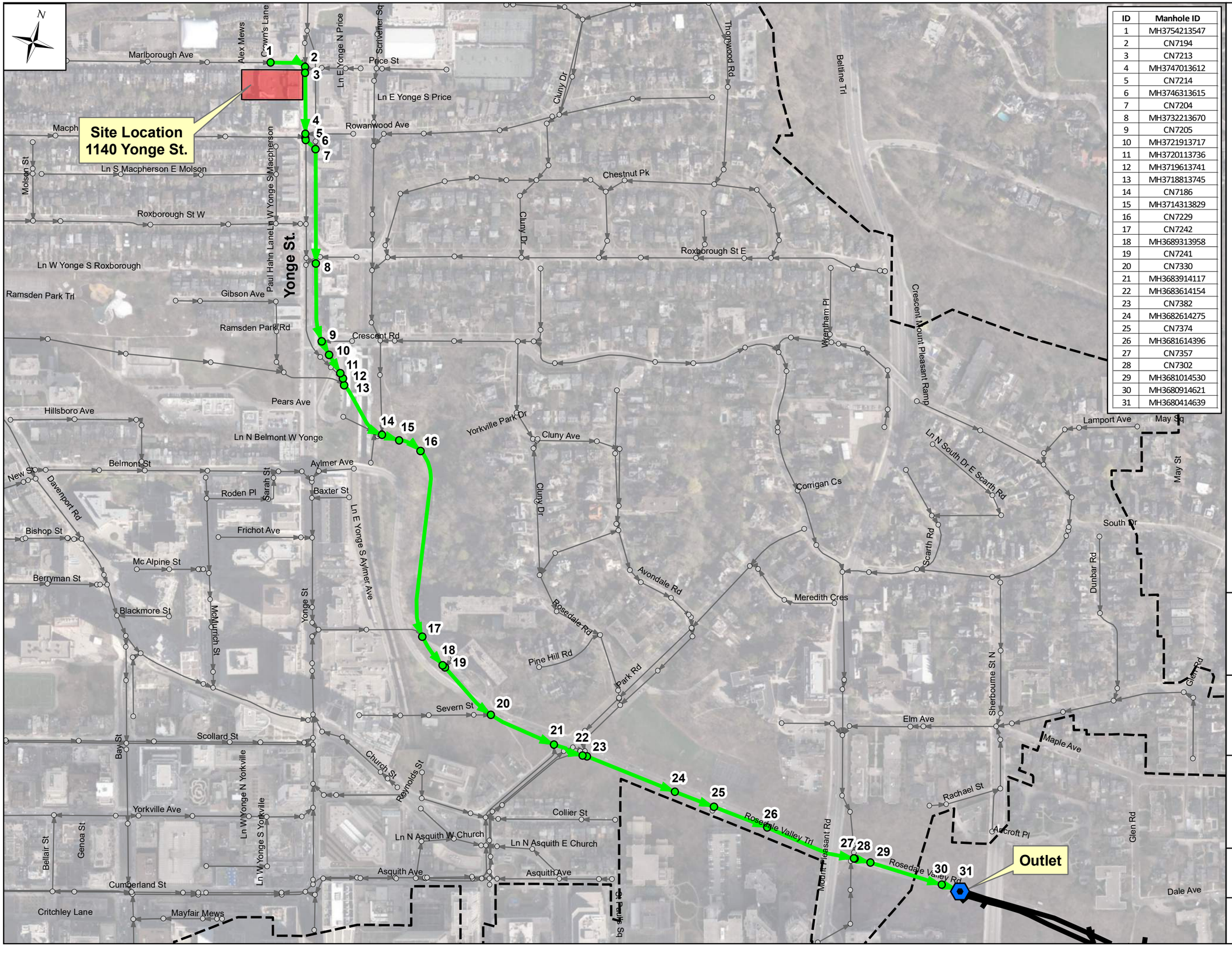
COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 4: Proposed Condition DWF Model Results

Drawn By: J.H. Date: Feb 20, 2020

0 50 100 200 Meters



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Legend

- Outlet
- Sanitary/Combined Manholes
- Sanitary/Combined Sewers
- Sanitary/Combined Trunk Sewers
- Sanitary/Combined Tributary Drainage Area Boundary
- Site Location

Sanitary/Combined Manholes

- At or Above Surface
- Within Basement Level (0 - 1.8 m)
- Below Basement (> 1.8 m)

Sanitary/Combined Sewers

- Surcharge State=2 (Bottleneck)
- Surcharge State=1 (Backup)
- Within Capacity (No Surcharge)

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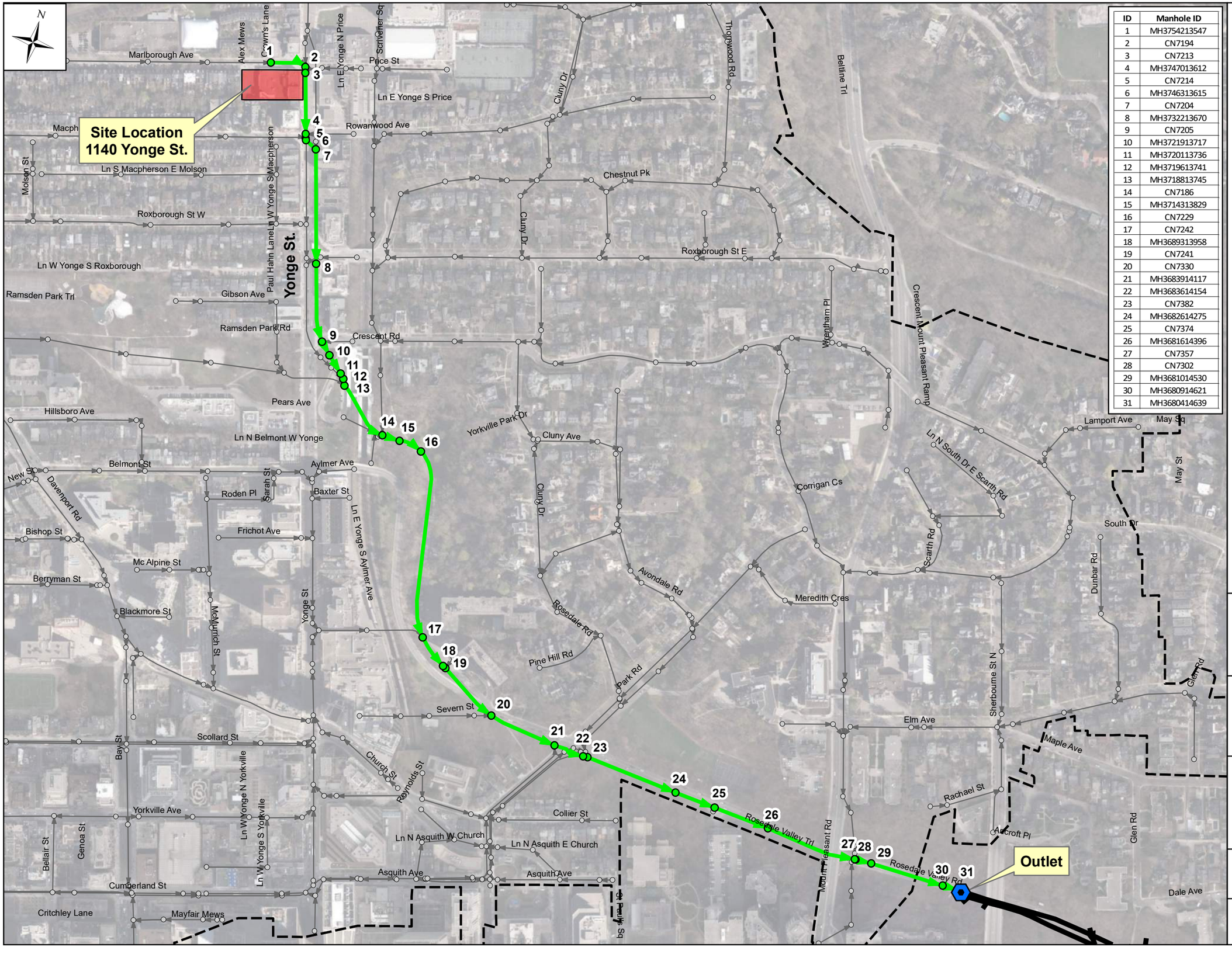
COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 5: Existing Condition Model Results - 100 Year Storm

Drawn By: J.H. Date: Feb 20, 2020

0 50 100 200 Meters



ID	Manhole ID
1	MH3754213547
2	CN7194
3	CN7213
4	MH3747013612
5	CN7214
6	MH3746313615
7	CN7204
8	MH3732213670
9	CN7205
10	MH3721913717
11	MH3720113736
12	MH3719613741
13	MH3718813745
14	CN7186
15	MH3714313829
16	CN7229
17	CN7242
18	MH3689313958
19	CN7241
20	CN7330
21	MH3683914117
22	MH3683614154
23	CN7382
24	MH3682614275
25	CN7374
26	MH3681614396
27	CN7357
28	CN7302
29	MH3681014530
30	MH3680914621
31	MH3680414639

Legend

- Outlet
- Sanitary/Combined Manholes
- Sanitary/Combined Sewers
- Sanitary/Combined Trunk Sewers
- Sanitary/Combined Tributary Drainage Area Boundary
- Site Location

Sanitary/Combined Manholes

- At or Above Surface
- Within Basement Level (0 - 1.8 m)
- Below Basement (> 1.8 m)

Sanitary/Combined Sewers

- Surcharge State=2 (Bottleneck)
- Surcharge State=1 (Backup)
- Within Capacity (No Surcharge)

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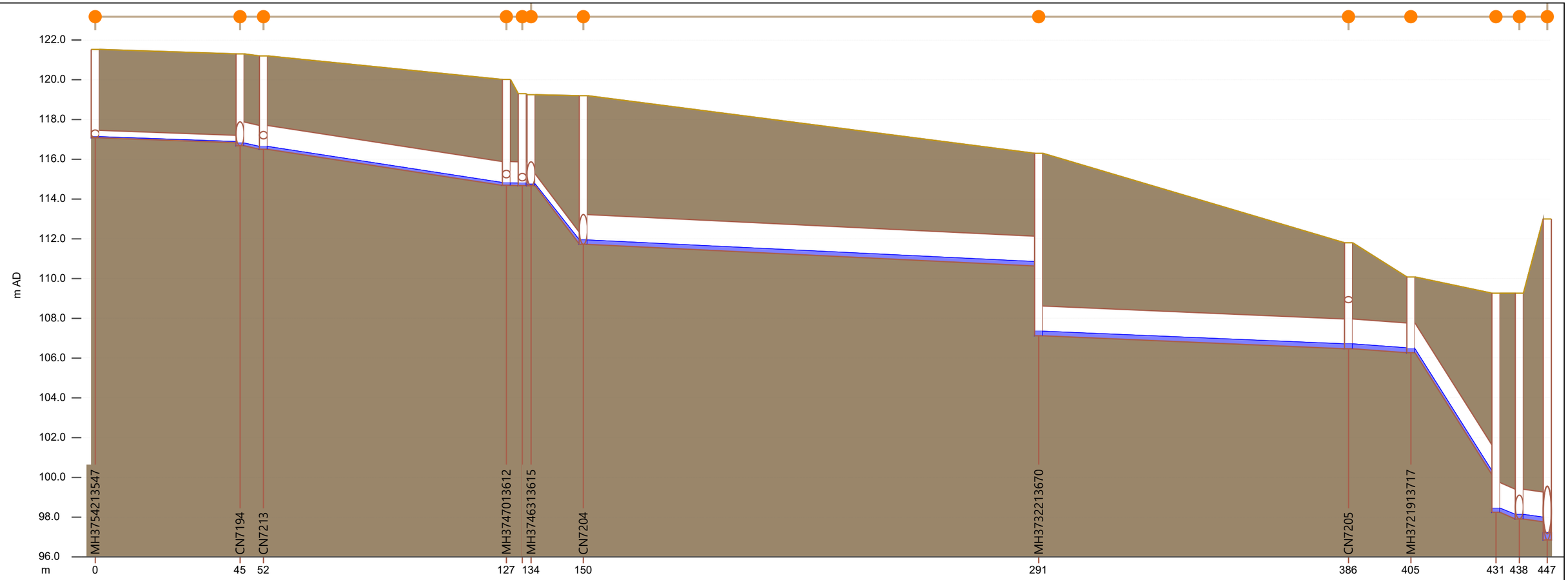
COU19-0128 - 1140 Yonge St - Downstream Capacity Analysis

Figure 6: Proposed Condition Model Results - 100 Year Storm

Drawn By: J.H. Date: Feb 20, 2020

0 50 100 200 Meters



Link	MH3754213547.1	-	CN7213.1	-	-	CN7204.1	MH3732213670.1	CN7205.1	-	-	-	
US node ID	MH3754213547	-	CN7213	-	-	CN7204	MH3732213670	CN7205	-	-	-	
ds node	CN7194	-	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	-	
length (m)	44.6	7.2	74.8	-	16.1	140.2	95.4	19.2	26.2	7.2	8.6	
width (mm)	375	-	750	-	600	1500	1500	1500	1500	-	-	
height (mm)	375	-	1200	-	600	1500	1500	1500	1500	-	-	
us inv (m AD)	117.081	-	116.504	-	114.670	111.721	107.123	106.471	106.270	-	-	
ds inv (m AD)	116.834	-	114.686	-	111.735	110.632	106.471	106.270	100.135	-	-	
grad (m/m)	0.00554	-	0.02430	-	0.18230	0.00777	0.00683	0.01047	0.23416	-	-	
pfc (m3/s)	0.131	-	2.978	-	2.622	6.231	5.845	7.234	34.211	-	-	
surc	0.12	-	0.11	-	0.33	0.14	0.16	0.16	0.12	-	0.15	
DS flow (m3/s)	0.00328	-	0.00765	-	0.01544	0.23290	0.23513	0.23518	0.23517	-	-	

Node	-	CN7194	CN7213	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	
ground (m AD)	121.528	121.300	121.200	120.013	-	119.200	116.301	111.800	110.080	-	-	
level (m AD)	117.127	116.806	116.634	114.797	-	111.931	107.339	106.704	106.444	98.439	-	
flood dep (m)	-4.401	-4.494	-4.566	-5.216	-	-7.269	-8.962	-5.096	-3.636	-10.827	-	

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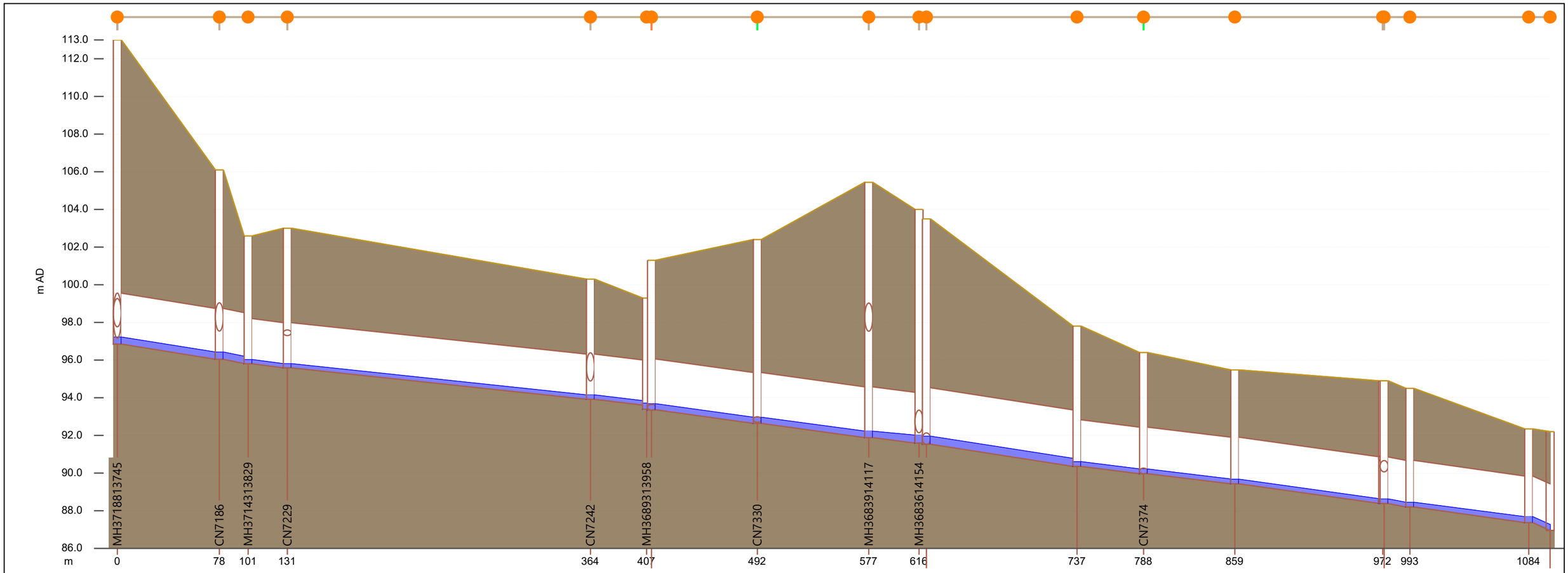
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Existing Conditions - DWF HGL Profile (from Site to Aylmer Ave)

DATE: 2/19/2020

Figure 7A



Link	MH3718813745.1	-	-	CN7229.1	-	CN7241.1	CN7330.1	-	CN7382.1	-	CN7374.1	MH3681614396.1	-	MH3681014530.1	-		
US node ID	MH3718813745	-	-	CN7229	CN7242	CN7241	CN7330	-	CN7382	-	CN7374	MH3681614396	-	MH3681014530	-		
ds node	CN7186	-	-	CN7242	-	CN7330	MH3683914117	-	MH3682614275	CN7374	MH3681614396	CN7357	-	MH3680914621	-		
length (m)	78.4	22.1	30.1	232.9	43.1	81.3	85.6	38.6	115.7	51.1	70.1	113.6	-	91.3	-		
width (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2625	2625	2625	-	2625	-		
height (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2475	2475	2475	-	2475	-		
us inv (m AD)	96.852	-	-	95.587	93.918	93.361	92.639	91.880	91.532	90.353	89.964	89.430	-	88.202	-		
ds inv (m AD)	96.045	-	-	93.918	93.609	92.639	91.880	91.591	90.353	89.964	89.430	88.393	-	87.369	-		
grad (m/m)	0.01029	-	-	0.00717	0.00717	0.00888	0.00887	0.00749	0.01019	0.00761	0.00762	0.00913	-	0.00912	-		
pfc (m3/s)	34.389	-	-	26.682	26.688	31.942	31.917	29.329	45.316	32.237	32.248	35.301	-	35.292	-		
surc	0.14	0.14	0.09	0.09	0.09	0.11	0.12	0.15	0.14	0.10	0.10	0.09	-	0.12	-		
DS flow (m3/s)	0.56281	-	-	0.64932	0.71364	0.71394	0.71547	0.72775	0.87250	0.87249	0.87247	0.87264	-	0.88866	-		
Node	-	CN7186	-	CN7229	CN7242	-	-	CN7330	-	-	CN7382	MH3682614275	CN7374	MH3681614396	CN7357	-	-
ground (m AD)	-	106.100	-	103.000	100.300	-	101.300	102.400	105.440	-	103.500	97.806	96.400	95.477	94.900	94.500	92.347
level (m AD)	97.211	96.414	-	95.797	94.137	-	93.670	92.949	92.211	-	91.944	90.591	90.202	89.659	88.624	88.433	87.669
flood dep (m)	-	-9.686	-	-7.203	-6.163	-	-7.630	-9.451	-13.229	-	-11.556	-7.215	-6.198	-5.818	-6.276	-6.067	-4.678

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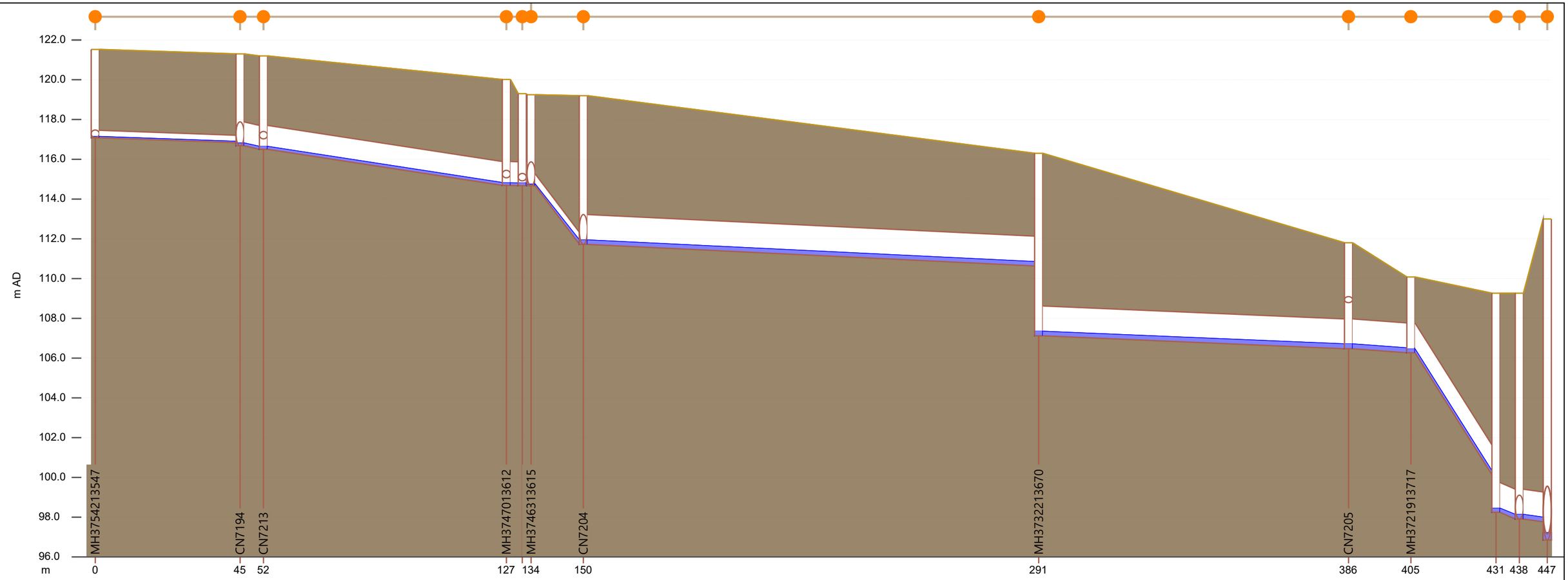
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Existing Conditions - DWF HGL Profile (from Aylmer Ave to Outlet)

DATE: 2/19/2020

Figure 7B



Link	MH3754213547.1	-	CN7213.1	-	-	CN7204.1	MH3732213670.1	CN7205.1	-	-	-
US node ID	MH3754213547	-	CN7213	-	-	CN7204	MH3732213670	CN7205	-	-	-
ds node	CN7194	-	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	-
length (m)	44.6	7.2	74.8	-	16.1	140.2	95.4	19.2	26.2	7.2	8.6
width (mm)	375	-	750	-	600	1500	1500	1500	1500	-	-
height (mm)	375	-	1200	-	600	1500	1500	1500	1500	-	-
us inv (m AD)	117.081	-	116.504	-	114.670	111.721	107.123	106.471	106.270	-	-
ds inv (m AD)	116.834	-	114.686	-	111.735	110.632	106.471	106.270	100.135	-	-
grad (m/m)	0.00554	-	0.02430	-	0.18230	0.00777	0.00683	0.01047	0.23416	-	-
pfc (m3/s)	0.131	-	2.978	-	2.622	6.231	5.845	7.234	34.211	-	-
surc	0.15	-	0.11	-	0.33	0.14	0.16	0.16	0.12	-	0.15
DS flow (m3/s)	0.00602	-	0.01040	-	0.01818	0.23554	0.23777	0.23782	0.23782	-	-

Node	-	CN7194	CN7213	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-
ground (m AD)	121.528	121.300	121.200	120.013	-	119.200	116.301	111.800	110.080	-	-
level (m AD)	117.138	116.809	116.637	114.806	-	111.932	107.339	106.705	106.444	98.440	-
flood dep (m)	-4.390	-4.491	-4.563	-5.207	-	-7.268	-8.962	-5.095	-3.636	-10.826	-

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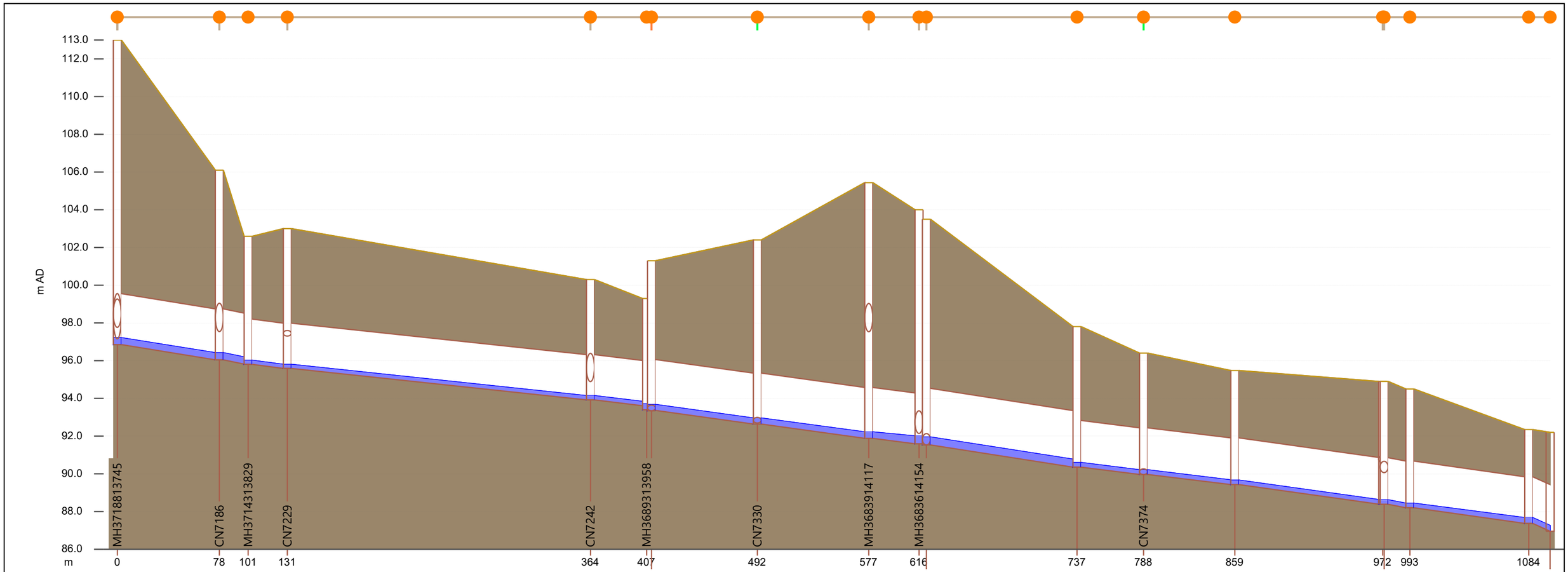
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Proposed Conditions - DWF HGL Profile (from Site to Aylmer Ave)

DATE: 2/19/2020

Figure 8A



Link	MH3718813745.1	-	-	CN7229.1	-	CN7241.1	CN7330.1	-	CN7382.1	-	CN7374.1	MH3681614396.1	-	MH3681014530.1	-		
US node ID	MH3718813745	-	-	CN7229	CN7242	CN7241	CN7330	-	CN7382	-	CN7374	MH3681614396	-	MH3681014530	-		
ds node	CN7186	-	-	CN7242	-	CN7330	MH3683914117	-	MH3682614275	CN7374	MH3681614396	CN7357	-	MH3680914621	-		
length (m)	78.4	22.1	30.1	232.9	43.1	81.3	85.6	38.6	115.7	51.1	70.1	113.6	-	91.3	-		
width (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2625	2625	2625	-	2625	-		
height (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2475	2475	2475	-	2475	-		
us inv (m AD)	96.852	-	-	95.587	93.918	93.361	92.639	91.880	91.532	90.353	89.964	89.430	-	88.202	-		
ds inv (m AD)	96.045	-	-	93.918	93.609	92.639	91.880	91.591	90.353	89.964	89.430	88.393	-	87.369	-		
grad (m/m)	0.01029	-	-	0.00717	0.00717	0.00888	0.00887	0.00749	0.01019	0.00761	0.00762	0.00913	-	0.00912	-		
pfc (m3/s)	34.389	-	-	26.682	26.688	31.942	31.917	29.329	45.316	32.237	32.248	35.301	-	35.292	-		
surc	0.14	0.14	0.09	0.09	0.09	0.11	0.12	0.15	0.14	0.10	0.10	0.09	-	0.12	-		
DS flow (m3/s)	0.56537	-	-	0.65188	0.71620	0.71651	0.71804	0.73034	0.87506	0.87504	0.87502	0.87519	-	0.89122	-		

Node	-	CN7186	-	CN7229	CN7242	-	-	CN7330	-	-	CN7382	MH3682614275	CN7374	MH3681614396	CN7357	-	-
ground (m AD)	-	106.100	-	103.000	100.300	-	101.300	102.400	105.440	-	103.500	97.806	96.400	95.477	94.900	94.500	92.347
level (m AD)	97.211	96.414	-	95.798	94.137	-	93.670	92.949	92.211	-	91.944	90.592	90.203	89.660	88.624	88.434	87.669
flood dep (m)	-	-9.686	-	-7.202	-6.163	-	-7.630	-9.451	-13.229	-	-11.556	-7.214	-6.197	-5.817	-6.276	-6.066	-4.678

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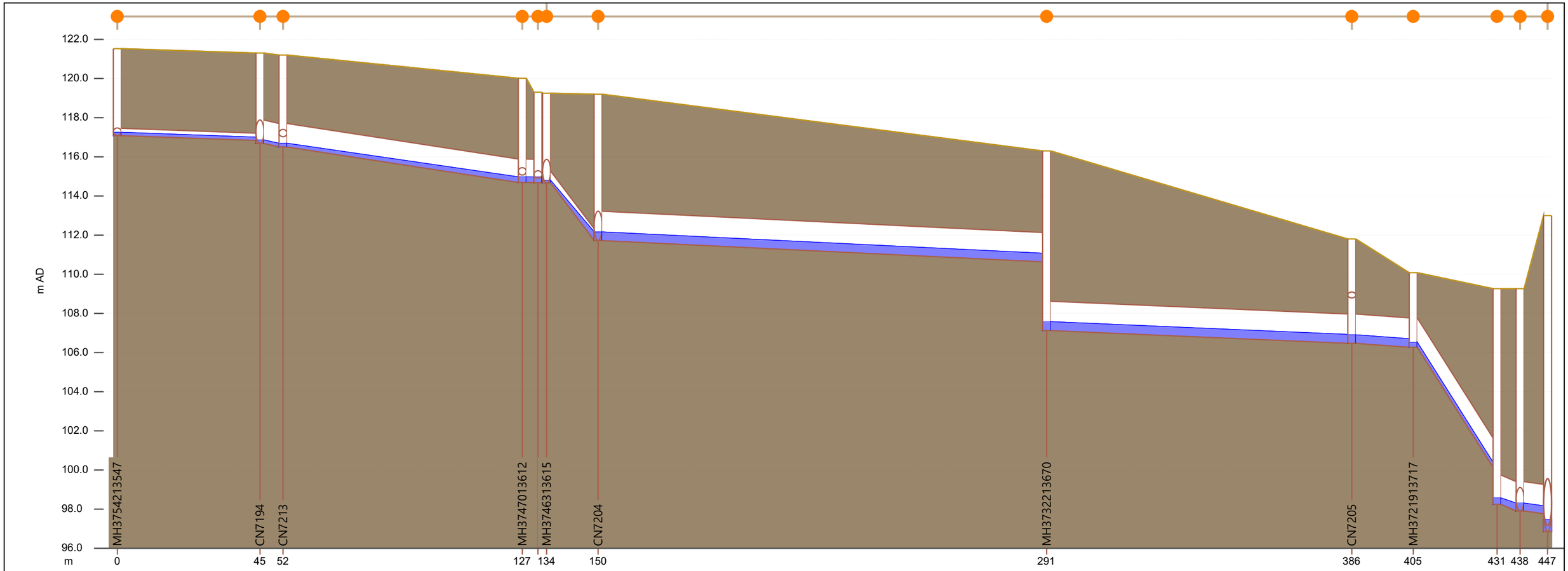
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Proposed Conditions - DWF HGL Profile (from Aylmer Ave to Outlet)

DATE: 2/19/2020

Figure 8B



Link	MH3754213547.1	-	CN7213.1	-	-	CN7204.1	MH3732213670.1	CN7205.1	-	-	-	
US node ID	MH3754213547	-	CN7213	-	-	CN7204	MH3732213670	CN7205	-	-	-	
ds node	CN7194	-	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	-	
length (m)	44.6	7.2	74.8	-	16.1	140.2	95.4	19.2	26.2	7.2	8.6	
width (mm)	375	-	750	-	600	1500	1500	1500	1500	-	-	
height (mm)	375	-	1200	-	600	1500	1500	1500	1500	-	-	
us inv (m AD)	117.081	-	116.504	-	114.670	111.721	107.123	106.471	106.270	-	-	
ds inv (m AD)	116.834	-	114.686	-	111.735	110.632	106.471	106.270	100.135	-	-	
grad (m/m)	0.00554	-	0.02430	-	0.18230	0.00777	0.00683	0.01047	0.23416	-	-	
pfc (m3/s)	0.131	-	2.978	-	2.622	6.231	5.845	7.234	34.211	-	-	
surc	0.42	-	0.23	-	0.69	0.29	0.29	0.28	0.15	-	0.26	
DS flow (m3/s)	0.04596	-	0.06161	-	0.12675	1.08283	1.08372	1.08430	1.08418	-	-	

Node	-	CN7194	CN7213	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-
ground (m AD)	121.528	121.300	121.200	120.013	-	119.200	116.301	111.800	110.080	-	-
level (m AD)	117.238	116.846	116.678	114.961	-	112.150	107.564	106.892	106.502	98.556	-
flood dep (m)	-4.290	-4.454	-4.522	-5.052	-	-7.050	-8.737	-4.908	-3.578	-10.710	-

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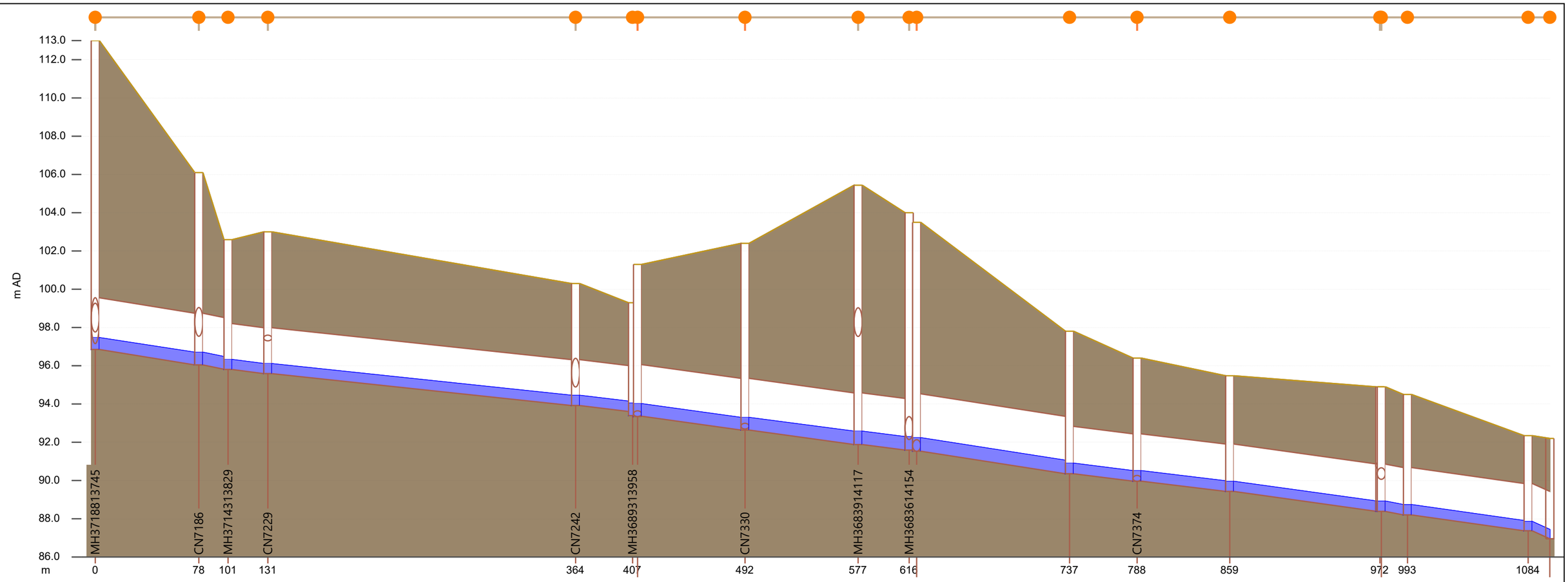
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Existing Conditions - 100-yr Storm HGL Profile (from Site to Aylmer Ave)

DATE: 2/19/2020

Figure 9A



Link	MH3718813745.1	-	-	CN7229.1	-	CN7241.1	CN7330.1	-	CN7382.1	-	CN7374.1	MH3681614396.1	-	MH3681014530.1	-		
US node ID	MH3718813745	-	-	CN7229	CN7242	CN7241	CN7330	-	CN7382	-	CN7374	MH3681614396	-	MH3681014530	-		
ds node	CN7186	-	-	CN7242	-	CN7330	MH3683914117	-	MH3682614275	CN7374	MH3681614396	CN7357	-	MH3680914621	-		
length (m)	78.4	22.1	30.1	232.9	43.1	81.3	85.6	38.6	115.7	51.1	70.1	113.6	-	91.3	-		
width (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2625	2625	2625	-	2625	-		
height (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2475	2475	2475	-	2475	-		
us inv (m AD)	96.852	-	-	95.587	93.918	93.361	92.639	91.880	91.532	90.353	89.964	89.430	-	88.202	-		
ds inv (m AD)	96.045	-	-	93.918	93.609	92.639	91.880	91.591	90.353	89.964	89.430	88.393	-	87.369	-		
grad (m/m)	0.01029	-	-	0.00717	0.00717	0.00888	0.00887	0.00749	0.01019	0.00761	0.00762	0.00913	-	0.00912	-		
pfc (m3/s)	34.389	-	-	26.682	26.688	31.942	31.917	29.329	45.316	32.237	32.248	35.301	-	35.292	-		
surc	0.24	0.24	0.21	0.22	0.22	0.24	0.25	0.26	0.23	0.22	0.22	0.21	-	0.21	-		
DS flow (m3/s)	3.14092	-	-	3.65205	3.84903	3.84858	3.84802	3.93435	4.42152	4.42002	4.41675	4.41743	-	4.60499	-		

Node	-	CN7186	-	CN7229	CN7242	-	-	CN7330	-	-	CN7382	MH3682614275	CN7374	MH3681614396	CN7357	-	-
ground (m AD)	-	106.100	-	103.000	100.300	-	101.300	102.400	105.440	-	103.500	97.806	96.400	95.477	94.900	94.500	92.347
level (m AD)	97.460	96.694	-	96.101	94.445	-	94.004	93.285	92.566	-	92.225	90.893	90.503	89.947	88.920	88.729	87.846
flood dep (m)	-	-9.406	-	-6.899	-5.855	-	-7.296	-9.115	-12.874	-	-11.275	-6.913	-5.897	-5.530	-5.980	-5.771	-4.501

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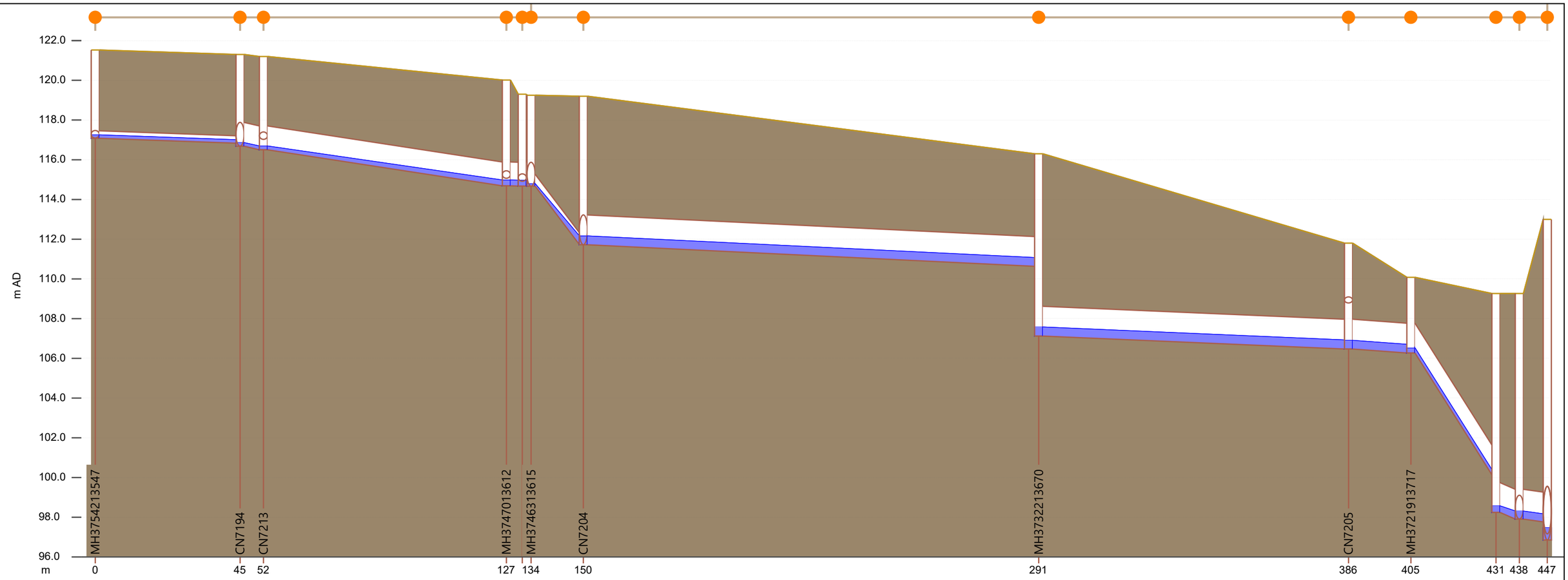
Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Existing Conditions - 100-yr Storm HGL Profile (from Aylmer Ave to Outlet)

DATE: 2/19/2020

Figure 9B



Link	MH3754213547.1	-	CN7213.1	-	-	CN7204.1	MH3732213670.1	CN7205.1	-	-	-	
US node ID	MH3754213547	-	CN7213	-	-	CN7204	MH3732213670	CN7205	-	-	-	
ds node	CN7194	-	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	-	
length (m)	44.6	7.2	74.8	-	16.1	140.2	95.4	19.2	26.2	7.2	8.6	
width (mm)	375	-	750	-	600	1500	1500	1500	1500	-	-	
height (mm)	375	-	1200	-	600	1500	1500	1500	1500	-	-	
us inv (m AD)	117.081	-	116.504	-	114.670	111.721	107.123	106.471	106.270	-	-	
ds inv (m AD)	116.834	-	114.686	-	111.735	110.632	106.471	106.270	100.135	-	-	
grad (m/m)	0.00554	-	0.02430	-	0.18230	0.00777	0.00683	0.01047	0.23416	-	-	
pfc (m3/s)	0.131	-	2.978	-	2.622	6.231	5.845	7.234	34.211	-	-	
surc	0.43	-	0.23	-	0.69	0.29	0.29	0.28	0.15	-	0.26	
DS flow (m3/s)	0.04817	-	0.06378	-	0.12890	1.08473	1.08564	1.08623	1.08610	-	-	

Node	-	CN7194	CN7213	MH3747013612	-	CN7204	MH3732213670	CN7205	-	-	-	
ground (m AD)	121.528	121.300	121.200	120.013	-	119.200	116.301	111.800	110.080	-	-	
level (m AD)	117.241	116.848	116.679	114.964	-	112.150	107.564	106.893	106.502	98.556	-	
flood dep (m)	-4.287	-4.452	-4.521	-5.049	-	-7.050	-8.737	-4.907	-3.578	-10.710	-	

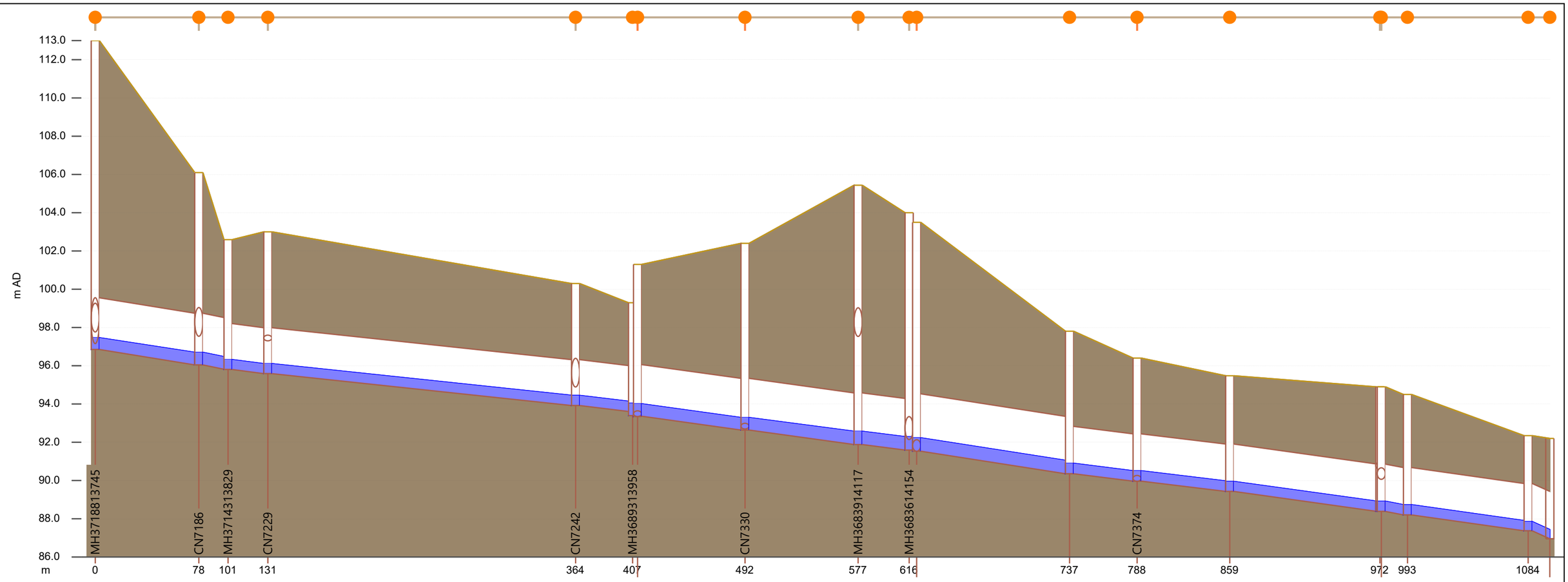
CIVICA
Water Management Solutions

Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Proposed Conditions - 100-yr Storm HGL Profile (from Site to Aylmer Ave)

DATE: 2/19/2020

Figure 10A



Link	MH3718813745.1	-	-	CN7229.1	-	CN7241.1	CN7330.1	-	CN7382.1	-	CN7374.1	MH3681614396.1	-	MH3681014530.1	-		
US node ID	MH3718813745	-	-	CN7229	CN7242	CN7241	CN7330	-	CN7382	-	CN7374	MH3681614396	-	MH3681014530	-		
ds node	CN7186	-	-	CN7242	-	CN7330	MH3683914117	-	MH3682614275	CN7374	MH3681614396	CN7357	-	MH3680914621	-		
length (m)	78.4	22.1	30.1	232.9	43.1	81.3	85.6	38.6	115.7	51.1	70.1	113.6	-	91.3	-		
width (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2625	2625	2625	-	2625	-		
height (mm)	2700	-	2400	2400	2400	2700	2700	2700	3000	2475	2475	2475	-	2475	-		
us inv (m AD)	96.852	-	-	95.587	93.918	93.361	92.639	91.880	91.532	90.353	89.964	89.430	-	88.202	-		
ds inv (m AD)	96.045	-	-	93.918	93.609	92.639	91.880	91.591	90.353	89.964	89.430	88.393	-	87.369	-		
grad (m/m)	0.01029	-	-	0.00717	0.00717	0.00888	0.00887	0.00749	0.01019	0.00761	0.00762	0.00913	-	0.00912	-		
pfc (m3/s)	34.389	-	-	26.682	26.688	31.942	31.917	29.329	45.316	32.237	32.248	35.301	-	35.292	-		
surc	0.24	0.24	0.21	0.22	0.22	0.24	0.25	0.26	0.23	0.22	0.22	0.21	-	0.21	-		
DS flow (m3/s)	3.14606	-	-	3.65805	3.85468	3.85454	3.85390	3.94063	4.42848	4.42709	4.42394	4.42447	-	4.61216	-		

Node	-	CN7186	-	CN7229	CN7242	-	-	CN7330	-	-	CN7382	MH3682614275	CN7374	MH3681614396	CN7357	-	-
ground (m AD)	-	106.100	-	103.000	100.300	-	101.300	102.400	105.440	-	103.500	97.806	96.400	95.477	94.900	94.500	92.347
level (m AD)	97.460	96.695	-	96.101	94.445	-	94.005	93.286	92.566	-	92.226	90.893	90.504	89.947	88.920	88.730	87.846
flood dep (m)	-	-9.405	-	-6.899	-5.855	-	-7.295	-9.114	-12.874	-	-11.274	-6.913	-5.896	-5.530	-5.980	-5.770	-4.501

CIVICA
Water Management Solutions

Project Code: COU19-0128
Project Name: 1140 Yonge St Downstream Capacity Analysis

Proposed Conditions - 100-yr Storm HGL Profile (from Aylmer Ave to Outlet)

DATE: 2/19/2020

Figure 10B

Appendix E

Counterpoint Engineering

Allowable Release Rate

Project Name: 1140 Yonge Street

Project Number: 18072

Rational Method - 2 Year Predevelopment

Event:		2	years
ABC's:	A	21.8	
	C	0.78	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.5	
Site Area	A	0.287	ha
Intensity	i	88.19	mm/hr
$i=A/(T)^c$			
Flow	Q	0.035	m^3/s
Q=CiA/360		**35.1**	**L/s**

Counterpoint Engineering

Predevelopment Flows

Project Name: 1140 Yonge Street

Project Number: 18072

Rational Method - 2 Year Predevelopment

Event:		2	years
ABC's:	A	21.8	
	C	0.78	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	88.19	mm/hr
Flow	Q	0.06	m^3/s
Q=CiA/360		**63**	**L/s**

Rational Method - 5 Year Predevelopment

Event:		5	years
ABC's:	A	32	
	C	0.79	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	131.79	mm/hr
Flow	Q	0.09	m^3/s
Q=CiA/360		**94**	L/s

Rational Method - 10 Year Predevelopment

Event:		10	years
ABC's:	A	38.7	
	C	0.8	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	162.27	mm/hr
Flow	Q	0.12	m^3/s
Q=CiA/360		**116**	L/s

Rational Method - 25 Year Predevelopment

Event:		25	years
ABC's:	A	45.2	
	C	0.8	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	189.52	mm/hr
Flow	Q	0.14	m^3/s
Q=CiA/360		**136**	L/s

Rational Method - 50 Year Predevelopment

Event:		50	years
ABC's:	A	53.5	
	C	0.8	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	224.32	mm/hr
Flow	Q	0.16	m^3/s
Q=CiA/360		**161**	L/s

Rational Method - 100 Year Predevelopment

Event:		100	years
ABC's:	A	59.7	
	C	0.8	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.9	
Site Area	A	0.287	ha
Intensity $i=A/(T)^c$	i	250.32	mm/hr
Flow	Q	0.18	m^3/s
Q=CiA/360		**179**	L/s

Counterpoint Engineering

Rational Method - Uncontrolled Area to Public Road Allowance

Project Name:		1140 Yonge Street	
Project No:		18072	
Event:		100	years
ABC's:	A	59.7	
	C	0.8	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.25	
Site Area	A	0.010	ha
Intensity	i	250.32	mm/hr
$i=A/(T)^c$			
Flow	Q	0.002	m^3/s
Q=CiA/360		**1.7**	**L/s**

counterpoint engineering

Project Name: 1140 Yonge Street
Project Number: 18072

Rainfall Data			
Location:	Toronto	a	59.7
Event	100 Year	b	0
		c	0.8

Area ID	Area (ha)	Runoff Coefficient	t_c (min)	Storage Available (m^3)	Storage Required (m^3)	100-Year Release Rate (L/s)	Description	Orifice Size (mm)	Orifice Release Rate (L/s)
UNC	0.010	0.25	10	N/A	0	1.7	Uncontrolled	-	N/A
SITE	0.277	0.79	10	72	72	32.3	Orifice Plate	100	32.3
	0.287			72	72	34.0			

1 On-site storage will be provided via an underground storage tank located within the building
2 Refer to **Appendix D** for modified rational calculations.

AREA ID SITE

Composite RC Value	Area [ha]	RC	RC * Area
Pervious Area	0.017	0.25	0.00
Green Roof	0.037	0.35	0.01
Building/Impervious Area	0.224	0.90	0.20
	0.277	Total	0.22
		Divided by Total Area :	0.79

AREA ID UNC

Composite RC Value	Area [ha]	RC	RC * Area
Pervious Area	0.010	0.25	0.00
Green Roof	0.000	0.35	0.00
Building/Impervious Area	0.000	0.90	0.00
	0.010	Total	0.00
		Divided by Total Area :	0.25

Counterpoint Engineering

Modified Rational **Area:** **SITE**

Project Name: 1140 Yonge Street
Project Number: 18072

Rainfall Data			
Location:	Toronto	a	59.700
Event	100 Year	b	0.000
		c	0.800

Site Data		
Area	0.277	ha
Runoff Coefficient	0.79	
AC	0.22	
Tc	10	
Time Increment	10	
Release Rate	32.3	L/s
Storage Required	72	m^3

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	250	0.15	91	19	72	********
20	144	0.09	105	39	66	
30	104	0.06	114	58	55	
40	83	0.05	120	78	43	
50	69	0.04	126	97	29	
60	60	0.04	130	116	14	
70	53	0.03	135	136	-1	
80	47	0.03	138	155	-17	
90	43	0.03	141	174	-33	
100	40	0.02	144	194	-49	
110	37	0.02	147	213	-66	
120	34	0.02	150	233	-83	
130	32	0.02	152	252	-100	
140	30	0.02	155	271	-117	
150	29	0.02	157	291	-134	
160	27	0.02	159	310	-151	
170	26	0.02	161	329	-169	
180	25	0.02	162	349	-186	
190	24	0.01	164	368	-204	
200	23	0.01	166	388	-222	
210	22	0.01	168	407	-239	
220	21	0.01	169	426	-257	
230	20	0.01	171	446	-275	

counterpoint engineering

SWM DESIGN CALCULATIONS
Orifice Calculations (Tank Outlet)

Project Name: 1140 Yonge Street
Municipality: Toronto
Project No.: 18072

Prepared by: R.S.

Orifice Equation:

$Q = C_d x A x (2gH)^{0.5}$ *g=9.81 (m/s^2) gravity*

C_d = coefficient of discharge

where: Q =flow rate (L/s)
H = head on the weir (m)
A =area of orifice (m^2)

C_d = 0.61 for Sharp Orifice
C_d = 0.81 for Tube Orifice

Orifice Characteristics

Orifice Diameter (mm)	**100**
C_d	**0.61**
Orifice Invert Elevation (m)	**118.31**
Spill-out Elevation (m)	**120.70**
Downstream Tailwater (m)	**118.31**
Head on Orifice (m)	2.34
Flow from Orifice (L/s)	**32.3**
Allowable Flow (L/s)	**33.4**

Counterpoint Engineering

Water Balance

1140 Yonge Street

City of Toronto's Green Standard Tier 2 Section QW 2.2

Initial Abstraction Asphalt, I	1	mm
Initial Abstraction Pervious, P	5	mm
Initial Abstraction Green Roof, GR	11	mm
Initial Abstraction Roof, R	1	mm
Toronto's small design rainfall event has 5mm excess rainfall		

Type of Area	Area	Units	% Redevelopment Area
Non-Green Roof and Impervious Area	0.223	ha	78%
Intensive Green Roof Area	0.025	ha	9%
Pervious Area	0.039	ha	14%
Total Area	0.287	ha	100%

Initial Abstraction= Percent Impervious (Roof) *R + Percent Intensive Green Roof * GR + Percent Previous *P

Initial Abstraction= 0.78 x 1mm + 0.09 x 11mm + 0.14 x 5mm

Initial Abstraction (credit)= 2.41 mm

Required Development Retention = (Excess Rainfall- Initial Abstraction) * (Total Development Area)

Required Development Retention = (10mm - 2.41 mm) x (0.287)ha

Required Development Retention (debit)=	21.8	m^3
Grey water usage within 72 hours:	15.8	m^3
72 hour Irrigation Demand:	6.0	m^3
Anticipated Car Wash Usage in 72 hours:	0.0	m^3
Shortfall (Tier 2):	**0.0**	**m^3**
Shortfall (Tier 3):	**43.0**	**m^3**

Smith + Andersen

4211 Yonge Street Suite 500 Toronto Ontario M2P 2A9
416 487 8151 f 416 487 9104 smithandandersen.com

2020-08-10

Devron Developments
31 Scarsdale Road, Unit 5
Toronto, Ontario
M3B 2R2

Attention: Mr. David Wittenberg

RE: **1140 YONGE STREET**
TORONTO, ONTARIO
S+A PROJECT # 19263.002.M001
STORM WATER REUSE STRATEGY

Dear Mr. Wittenberg:

This letter is to confirm that as part of our mechanical design for 1140 Yonge Street, we will utilize the reclaimed storm water to supply water to water closets in the commercial spaces of the building.

It our understanding that 23.3 m^3 of water shall be used on site within 72 hours. Of this volume, 15.8 m^3 will be reused internally to supply grey water to water closets in the commercial spaces. This volume is based on the following:

- Approximately 1114 people occupying 1225 m^2 of commercial space
- 35 water closets required for this quantity of occupants (including dining guests and employees)
- For each water closet installed, 6 litres per flush and 25 flushes per day.

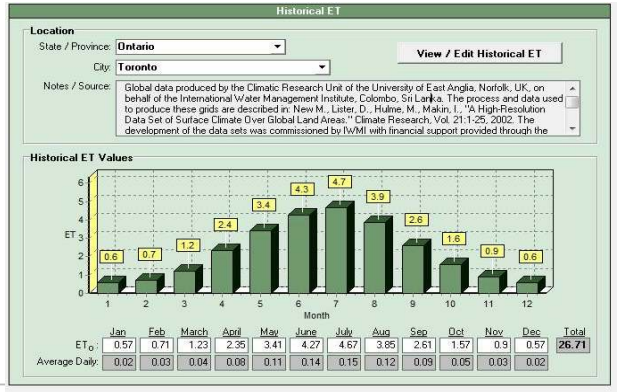
Yours truly,

Smith + Andersen

Bram Atlin P.Eng., LEED AP
Principal
d 416 218 7045 m 416 895 9825
bram.atlin@smithandandersen.com
19263.002.m.001.l002 (Stormwater Reuse)

CIS
Creative Irrigation Solutions Inc.

The following is the water requirement calculation for **1140 YONGE STREET, Toronto Ont.**. An irrigations system will be design to distribute the water required to maintain plant life. The system, as well as the calculations, take into consideration the plant material and the different plant species water requirements.
As part of the irrigation design, a pumping system has been designed and specified with the capacity to deliver the required flow rates and pressure to the ground level as well as the green roof area.
This document will verify the irrigation system's portion in the water management process. The formula seen below is used world wide to determine landscape water requirements. The Landscape Coefficient is base on the plant material and in conjunction with the LEED standards and calculating system (Standard LEED Calculator). The Distribution Uniformity figures are base on the same criteria as the Landscape Coefficient and are in line with the manufactures data sheet claims . The Effective Rainfall is a constant % used in all Water Requirement calculations.
The Reference Evapotranspiration rate is based on the rates used by Rainbird for all their E.T. based Controllers in the City of Toronto and comes from Global data produced by the Climatic Research Unit of the University of East Anglia, Norfolk, UK, on behalf of the International Water Management Institute, Colombo, Sri Lanka. The process and data used to produce these grids are described in: New M., Lister, D., Hulme, M., Makin, I., "A High-Resolution Data Set of Surface Climate Over Global Land Areas." Climate Research, Vol. 21:1-25, 2002. The development of the data sets was commissioned by IWMI with financial support provided through the United States Assistance International Development (USAID) and the Official Development Assistance of the Government of Japan. The station data used in the data set have been collated over many years at the Climatic Research.



Water Requirement Calculations For 1140 YONGE STREET, Toronto, Ontario

$$WR = \frac{((ET0 \times KL) - Re) \times A}{DU \times EWM \times CU}$$

WR = Water Requirement
ET0 = Reference Evapotranspiration
KL = Landscape Coefficient
CU = Constant to Arrive at 1000's of Gallons
Re = Effective Rainfall
A = Area in Acres
DU = Distribution Uniformity

Total Combined WR in Cubic Metres

May	46.22
June	67.00
July	80.85
August	67.00
September	46.22
Total WR M^3:	307.30
Average Daily Water Use (153 Days)	2.01
Average 72 Hour Water Use	6.03

ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainfall in mm	July Base Re.(50% effctive rainfa in inches	Area M^2	Area (Acres)	DU (Distributio Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requiren in 1000's of Gallons)	WR (in M^3)
118.618	4.67	0.7	33.02	1.30	417.95	0.103278	0.75	0.85	0.0368	8.67	32.81
118.618	4.67	0.65	33.02	1.30	2.50	0.000618	0.75	0.85	0.0368	0.05	0.17
118.618	4.67	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
118.618	4.67	0.65	33.02	1.30	64.70	0.015988	0.75	0.85	0.0368	1.18	4.48
118.618	4.67	0.65	33.02	1.30	170.99	0.042253	0.75	0.85	0.0368	3.13	11.83
118.618	4.67	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
118.618	4.67	0.65	33.02	1.30	547.20	0.135216	0.9	0.85	0.0368	8.34	31.55

Irrigation Area	% (persentage 0f July Referance)	ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainfa in mm	May Re.(50% effctive rainfall in inches	Area M^2	Area (Acres)	DU (Distribution Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requirement in 1000's of Gallons)	WR (in M^3)
Trees	75%	88.9635	3.5025	0.7	33.02	1.30	417.95	0.1032776	0.75	0.85	0.0368	5.07	19.19
Mixed P	75%	88.9635	3.5025	0.65	33.02	1.30	2.50	0.0006178	0.75	0.85	0.0368	0.03	0.10
Planting	75%	88.9635	3.5025	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
Shrubs	75%	88.9635	3.5025	0.65	33.02	1.30	64.70	0.0159877	0.75	0.85	0.0368	0.67	2.52
Grn/Cov	75%	88.9635	3.5025	0.65	33.02	1.30	170.99	0.0422525	0.75	0.85	0.0368	1.76	6.66
Sod	75%	88.9635	3.5025	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
In.Gr Roof	75%	88.9635	3.5025	0.65	33.02	1.30	547.20	0.1352159	0.9	0.85	0.0368	4.69	17.76
												Total for Month	46.22
												Scheduled Irrigation Flow Per 72 Hours in M^3:	4.47

Irrigation Area	% (persentage 0f July Referance)	ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainfa in mm	June Re.(50% effctive rainfall in inches	Area M^2	Area (Acres)	DU (Distribution Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requirement in 1000's of Gallons)	WR (in M^3)
Trees	90%	106.7562	4.203	0.7	33.02	1.30	417.95	0.1032776	0.75	0.85	0.0368	7.23	27.36
Mixed P	90%	106.7562	4.203	0.65	33.02	1.30	2.50	0.0006178	0.75	0.85	0.0368	0.04	0.14
Planting	90%	106.7562	4.203	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
Shrubs	90%	106.7562	4.203	0.65	33.02	1.30	64.70	0.0160	0.75	0.85	0.0368	0.98	3.69
Grn/Cov	90%	106.7562	4.203	0.65	33.02	1.30	170.99	0.0422525	0.75	0.85	0.0368	2.58	9.76
Sod	90%	106.7562	4.203	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
In.Gr Roof	90%	106.7562	4.203	0.65	33.02	1.30	547.20	0.1352159	0.9	0.85	0.0368	6.88	26.04
												Total for Month	67.00
												Scheduled Irrigation Flow Per 72 Hours in M^3:	6.70

Irrigation Area	% (persentage 0f July Referance)	ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainfa in mm	July Re.(50% effctive rainfall in inches	Area M^2	Area (Acres)	DU (Distribution Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requirement in 1000's of Gallons)	WR (in M^3)
Trees	100%	118.618	4.67	0.7	33.02	1.30	417.95	0.1032776	0.75	0.85	0.0368	8.67	32.81
Mixed P	100%	118.618	4.67	0.65	33.02	1.30	2.50	0.0006178	0.75	0.85	0.0368	0.05	0.17
Planting	100%	118.618	4.67	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
Shrubs	100%	118.618	4.67	0.65	33.02	1.30	64.70	0.0160	0.75	0.85	0.0368	1.18	4.48
Grn/Cov	100%	118.618	4.67	0.65	33.02	1.30	170.99	0.0422525	0.75	0.85	0.0368	3.13	11.83
Sod	100%	118.618	4.67	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00
In.Gr Roof	100%	118.618	4.67	0.65	33.02	1.30	547.20	0.1352159	0.9	0.85	0.0368	8.34	31.55

													Total for Month	80.85
													Scheduled Irrigation Flow Per 72 Hours in M^3:	7.82
Irrigation Area	% (persentage 0f July Referance)	ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainf in mm	August Re.(50% effctive rainfall in inches	Area M^2	Area (Acres)	DU (Distribution Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requirement in 1000's of Gallons)	WR (in M^3)	
Trees	90%	106.7562	4.203	0.7	33.02	1.30	417.95	0.1032776	0.75	0.85	0.0368	7.23	27.36	
Mixed P	90%	106.7562	4.203	0.65	33.02	1.30	2.50	0.0006178	0.75	0.85	0.0368	0.04	0.14	
Planting	90%	106.7562	4.203	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00	
Shrubs	90%	106.7562	4.203	0.65	33.02	1.30	64.70	0.0160	0.75	0.85	0.0368	0.98	3.69	
Grn/Cov	90%	106.7562	4.203	0.65	33.02	1.30	170.99	0.0422525	0.75	0.85	0.0368	2.58	9.76	
Sod	90%	106.7562	4.203	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00	
In.Gr Roof	90%	106.7562	4.203	0.65	33.02	1.30	547.20	0.1352159	0.9	0.85	0.0368	6.88	26.04	
													Total for Month	67.00
													Scheduled Irrigation Flow Per 72 Hours in M^3:	6.48
Irrigation Area	% (persentage 0f July Referance)	ET。 (reference in mm)	ET。 (reference in inches)	K_L Landscape Coefficent	Re.(50% effctive rainf in mm	September Re.(50% effctive rainfall in inches	Area M^2	Area (Acres)	DU (Distribution Uniformity)	EWM (water manger efficiency-good	CU (convertion factor 1000's	WR (water requirement in 1000's of Gallons)	WR (in M^3)	
Trees	75%	88.9635	3.5025	0.7	33.02	1.30	417.95	0.1032776	0.75	0.85	0.0368	5.07	19.19	
Mixed P	75%	88.9635	3.5025	0.65	33.02	1.30	2.50	0.0006178	0.75	0.85	0.0368	0.03	0.10	
Planting	75%	88.9635	3.5025	0.65	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00	
Shrubs	75%	88.9635	3.5025	0.65	33.02	1.30	64.70	0.01599	0.75	0.85	0.0368	0.67	2.52	
Grn/Cov	75%	88.9635	3.5025	0.65	33.02	1.30	170.99	0.0422525	0.75	0.85	0.0368	1.76	6.66	
Sod	75%	88.9635	3.5025	0.77	33.02	1.30	0.00	0	0.75	0.85	0.0368	0.00	0.00	
In.Gr Roof	75%	88.9635	3.5025	0.65	33.02	1.30	547.20	0.1352159	0.9	0.85	0.0368	4.69	17.76	
													Total for Month	46.22
													Scheduled Irrigation Flow Per 72 Hours in M^3:	4.62

Submitted by: Joe Carter

August 6 ,2020

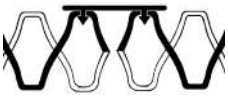
Joseph Carter
Creative Irrigation Solutions Inc.

Conserving Water is our Business. Serving Clients is our Focus. ®

Product Information
Floradrain® FD 40-E

Order No. 3041

Drainage and water storage element of recycled polyethylene for use on extensive and intensive green roofs with or without slope.



Technical Data

Floradrain® FD 40-E

Drainage and water storage element of thermoformed recycled polyethylene.

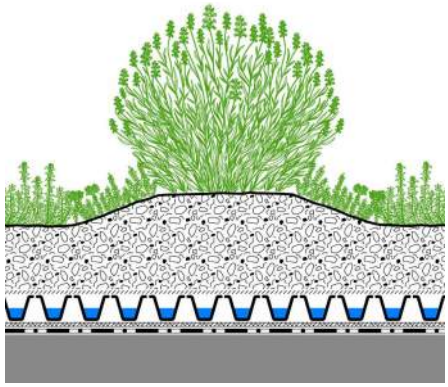
Material:	PE-HD
Colour:	dark grey
Height:	ca. 40 mm
Weight:	ca. 2.2 kg/m²
Diffusion opening:	ca. 2 mm
Water storage capacity:	ca. 6 l/m²
Filling volume:	ca. 17 l/m²
Compressive strength at 10 % compression	
without filling:	ca. 170 kN/m²
with filling:	ca. 250 kN/m²
In-plane water flow capacity (EN ISO 12958):	
roof slope 1 %:	ca. 1.5 l/(s·m)
roof slope 2 %:	ca. 2.1 l/(s·m)
roof slope 3 %:	ca. 2.6 l/(s·m)
Dimensions:	ca. 1.00 m x 2.00 m
Accessories:	
Plastic Connector (to be pressed into diffusion openings)	Order No. 9620

Features

- universal element for extensive and intensive green roof build-ups
- high drainage capacity
- also suitable for roofs without slope
- water storage even on sloped roof
- walkable
- biologically neutral
- quick and easy installation
- joint connector as accessory available

Application Example

"Semi-intensive Green Roof"



Plant layer "Heather with Lavender"

System Substrate
"Heather with Lavender", ca. 120 l/m²
Filter Sheet SF
Floradrain® FD 40-E
Protection Mat SSM 45
Roof construction with root resistant waterproofing

Specification Suggestion

Drainage and water storage element of polyethylene, height ca. 40 mm, max. compressive strength (without filling) 170 kN/m², with water storage cells and openings for ventilation and evaporation as well as multidirectional drainage channel system on the underside, in-plane water flow capacity tested according to EN ISO 12958, delivery and installation according to manufacturer`s instructions.

Make: ZinCo Floradrain® FD 40-E
Enquiries: ZinCo Canada Inc.
Phone: 1-905-690-1661

ZinCo Canada Inc.
P.O. Box 29 · Carlisle · L0R 1H0 · Ontario
Phone 1-905-690-1661 · Fax 1-905-689-0432
greenroof@zinco.ca · www.zinco.ca

Product Data Sheet
Protection Mat SSM 45

Order No. 2045

Water and nutrient storage mat of synthetic fibres, for the application as a protection layer under green roofs, gravel fills, slab pavings, etc.

Recycling for a better environment

Technical Data

Protection Mat SSM 45

High quality fibre mat made of polyester/polypropylene, with fleece backing.

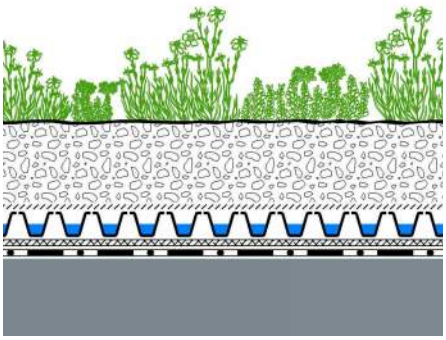
Thickness:	ca. 5 mm
Weight:	ca. 470 g/m²
Colour:	brown mottled
Water storage capacity:	ca. 5 l/m²
Tensile strength according	
To EN ISO 10319:	> 8.5 kN/m
Extension lengthwise:	> 90 %
Penetration force according	
To EN ISO 12236:	> 2400 N
Strength class:	3
Dimensions:	
Roll width:	ca. 2.00 m
Roll length:	ca. 50.00 m

Features

- resistant to mechanical stress
- protection layer according to German Standard DIN 18195, Part 5
- water and nutrient storage
- non-rotting
- biologically neutral
- bitumen and polystyrene compatible
- made of recycled fibres
- quick and easy installation

Application Example

"Extensive Green Roof"



Plant layer
e. g. "Rockery Type Plants"

System Substrate "Rockery Type Plants"

Filter Sheet SF
Floradrain® FD 25-E
Protection Mat SSM 45
Roof construction with
root resistant waterproofing

Specification Suggestion

High quality, non-rotting synthetic fibre mat as mechanical protection layer according to German Standard DIN 18195, Part 5; strength class 3, thickness ca. 5 mm, weight ca. 470 g/m², delivery and installation according to manufacturer's instructions.

Make: ZinCo Protection Mat SSM 45
Enquiries: ZinCo Canada Inc.
Phone: 1-905-690-1661

ZinCo Canada Inc.
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